THE HEATING AND VENTILATING MAGAZINE

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# AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

## *Report of Transactions, Twelfth Annual Meeting*

***New York, January 16, 17 and 18, 1906***

The annual meeting of a prosperous and progressive society and a program that promised something above the average were the inducements that led to the gathering of nearly 150 members and guests of the American Society of Heating and Ventilating Engineers at its annual meeting in New York, January 16, 17, and 18, last. Among those present were the following:

OFFICERS

Wm. Kent, Syracuse, N. Y.
R. P. Bolton, New York.
C. B. J. Snyder, New York.
W. M. Mackay, New York.
U. G. Scollay, Brooklyn, N. Y.
B. H. Carpenter, Wilkes-Barre, Pa.

MEMBERS AND GUESTS

C. F. Armitage, Jamestown, N. Y.
N. P. Andrus, Brooklyn, N. Y.
A. S. Armagnac, New York.
Homer Addams, New York.
George W. Barr, Philadelphia, Pa.
F. P. Blodgett, New York.
P. W. Butler, Scranton, Pa.
C. R. Bradbury, Philadelphia, Pa.
Chas. R. Bishop, Lockport, N. Y.
E. W. Barnes, New York.
John P. Bird, Putnam, Conn.
E. S. Berry, Philadelphia, Pa.
John Boylston, Chicago, Ill.
E. L. W. Burgess, New York.
Hugh J. Barron, New York.
Thomas Barwick, New York.
J. J. Blackmore, New York.
J. B. Bernhard, New York.
John S. Brennan, Milwaukee, Wis.
W. Bloos, New York.
Frank K. Chew, New York.
R. C. Carpenter, Ithaca, N. Y.
F. N. Cryer, New York.
A. A. Cryer, New York.
J. M. Collins, Brooklyn, N. Y.
R. R. M. Carpenter, Wilmington, Del.
George W. Clark, Newark, N. J.
Albert A. Cary, New York.
R. T. Childe, New York.
Frank J. Corbett, New York.
H. D. Carter, New York.
William A. Davis, New York.
Henry A. Desper, Worcester, Mass.
Edward B. Denny, Newark, N. J.
Robert C. Denny, Newark, N. J.
W. H. Driscoll, Jersey City, N. J.
Burt C. Davis, Kansas City, Mo.
W. C. J. Doolittle, Utica, N. Y.
James A. Donnelly, New York.
James H. Davis, Chicago, Ill.
A. C. Edgar, Philadelphia, Pa.
F. C. Faulkner, New York.
A. M. Feldman, New York.
E. J. Febrey, Washington, D. C.
J. C. Franklin, New York.
Albert B. Franklin, Boston, Mass.
F. H. Fabricius, New York.
C. H. Fay, Newark, N. J.
Henry B. Gombers, New York.
John Gormly, Philadelphia, Pa.
C. J. Group, Syracuse, N. Y.
Joseph Graham, New York.
Judson A. Goodrich, New York.
William Grier, New York.
August Geiger, Philadelphia, Pa.
W. H. Gaylord, Binghamton, N. Y.
H. T. Greene, Jr., Tarrytown, N. Y.
W. H. Howard, New York.
Newlin Haines, Atlantic City, N. J.
Alfred F. Howe, New York.
George D. Hoffman, New York.
B. N. Hurd, New York.
B. S. Harrison, New York.
H. H. Hellerman, Philadelphia, Pa.
James A. Harding, Boston, Mass.
Richard Hankin, New York.
Frederick D. B. Ingalls, Syracuse, N. Y.
Herbert A. Joslin, New York.

F. George Klemm, Jr., Philadelphia, Pa.
Martin L. Kaiser, Wilkes-Barre, Pa.
W. S. Kiethan, New York.
Conway Kiewitz, New York.
C. V. Kellogg, Chicago, Ill.
A. W. Katlin, New York.
A. H. Kiehl, New York.
J. J. Lyle, Philadelphia, Pa.
S. R. Lewis, Chicago, Ill.
Floyd H. Nettleton, New York.
Clarence M. Lyman, Utica, N. Y.
Charles Morrison, Boston, Mass.
W. W. Macon, New York.
L. P. Monash, New York.
Harry J. Marks, New York.
William H. McKiever, New York.
Robert Mayo, Jr., Washington, D. C.
C. D. McArthur, New York.
T. F. Morris, Brooklyn, N. Y.
John Mosner, New York.
James Mackay, Chicago, Ill.
F. G. McCann, New York.
W. S. Newkirk, New York.
C. A. Nisen, New York.
Herbert W. Nowell, New York.
C. W. Old, New York.
Millard P. Osbourn, Camden, N. J.
C. E. Oldacre, Philadelphia, Pa.
E. J. Olmstead, Brooklyn, N. Y.
George O'Hanlon, New York.
A. J. O'Neill, New York.
John A. Payne, Jersey City, N. J.
Lee Phillips, Boston, Mass.
H. M. Quackenboss, New York.
D. M. Quay, New York.
G. A. Robertson, Brooklyn, N. Y.
C. L. Riley, New York.
Henry H. Ritter, New York.
C. W. Rogers, Chicago, Ill.
J. R. Shanklin, Charleston, W. Va.
Frank Stoy, Atlantic City, N. J.
Fred A. Scheffler, Glen Ridge, N. J.
Fred'k F. Schnetz, New York.
Percival H. Seward, New York.
L. B. Sherman, New York.
Percy A. Sanquinetti, New York.
D. Stewart, Wilkes-Barre, Pa.
E. F. Singer, Baltimore, Md.
William G. Snow, Boston, Mass.
W. R. Stockwell, Irvington, N. Y.
Fred C. Smith, Boston, Mass.
B. F. Stangland, New York.
H. A. Smith, New York.
A. H. Schroth, Chicago, Ill.
M. V. Smith, New York.
Thos. N. Thomson, Scranton, Pa.
C. Teran, New York.
Walter Thompson, Jersey City, N. J.
John Trainor, Baltimore, Md.
M. C. Vrooman, Schenectady, N. Y.
George A. Weld, Boston, Mass.
Louis H. Wheeler, Hancock, N. Y.
H. S. Welsh, Rochester, N. Y.
H. H. Walker, New York.
L. J. Wing, New York.
A. O. Weld, Brooklyn, N. Y.
J. J. Wilson, Philadelphia, Pa.
Warren Webster, Camden, N. J.
H. A. Wilson, Boston, Mass.
C I. Warren, New York.
William S. Washburn, Brockton, Mass.
Wiltsie F. Wolfe, Philadelphia, Pa.
Charles F. Webber, New York.

SPECIAL COMMITTEES

Outside of the regular business transacted at this meeting, as outlined in the program, perhaps the most important action taken was the appointment of several special committees, one to collect data on steam mains and returns, one to collect data on steam heating of small buildings, one to collect data on hot water heating and one to confer with the New York city authorities regarding a proposed new building code for the metropolis. In addition to this, last year's committee to collect data an furnace heating was reappointed. The make-up of these special committees is as follows:

TO COLLECT DATA ON STEAM MAINS AND RETURNS

James A. Donnelly, New York.
Hugh J. Barron, New York.
Frank G. McCann, New York.

TO COLLECT DATA ON STEAM HEATING OF SMALL BUILDINGS

J. J. Blackmore, New York.
A. M. Feldman, New York.
B. H. Carpenter, Wilkes-Barre, Pa.

TO COLLECT DATA ON HOT WATER HEATING

James Mackay, Chicago.
E. F. Capron, Chicago.
Samuel R. Lewis, Chicago.

NEW YORK BUILDING CODE

U. G. Scollay, Brooklyn, N. Y.
R. P. Bolton, New York.
D. M. Quay, New York.

TO COLLECT DATA ON FURNACE HEATING

Prof. William Kent, Syracuse, N. Y.
Frank K. Chew, New York.
C. E. Oldacre, Philadelphia, Pa.

## OPENING SESSION, TUESDAY AFTERNOON, JANUARY 16

After the meeting had been called to order by President William Kent, of Syracuse, N. Y., the secretary announced the election of the following members since the previous meeting: Charles G. Armstrong, New York; F. W. C. Bailey, Cincinnati, O.; Charles H. Basshor, Baltimore, Md.; William L. Bowers, Spokane, Wash.; Edward B. Denny, Newark, N. J.; William C. J. Doolittle, Utica, N. Y.; Willard B. Graves, Chicago, Ill.; Frederick D. Ingalls, Syracuse, N. Y.; Warren S. Johnson, Milwaukee, Wis.; Samuel Kauffman, St. Louis, Mo.; James H. Merritt, New York; William A. Pope, Chicago, Ill.; Frederick Sabin, Philadelphia, Pa.; Oliver H. Schlemmer, Cincinnati, O.; James M. Stannard, Chicago, Ill.; Harry S. Welsh, Rochester, N. Y.; Lewis A. Larsen (associate), Duluth, Minn.; Charles J. Group (junior), Syracuse, N. Y., and Lee Phillips (junior), Philadelphia, Pa.

GROUP OF MEMBERS AND GUESTS PRESENT AT THE TWELFTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

A picture likely to become historic, as it may be the last meeting to be held in the rooms of the Mechanical Engineers' Society.

President Kent then read his address:

**President's Address**

In opening the twelfth annual meeting of the Society of Heating and Ventilating Engineers, it is my great pleasure to congratulate the society upon the progress it has made during the past year. The reports of the Secretary and of the Board of Governors will show that the membership has increased more rapidly than in any preceding year, and the annual and semi-annual meetings have been attended by greater numbers than ever before. The society, having lived and grown for twelve years, may now be said to have satisfactorily proved that it has a reason for existence, and its future steady growth may safely be predicted.

I desire in this address to give expression to a few facts concerning the present status of the heating and ventilating art. During the last twelve years, or since the society was founded, there has been a notable advance in heating and ventilating practice, but a very trifling advance in scientific research, and still less in the reduction of the results of research to formulas, theoretical or empirical, which can conveniently be used in practice.

The advance in practice has been due to necessity. The demand for larger and more effective and more reliable apparatus springs first from the increased wealth of the country, which causes the erection of larger and more costly buildings; second, from the increase of luxurious habits of the people, requiring more heating and ventilating and less trouble in manipulating or regulating the apparatus; third, in the better education of the people as to the desirability of thorough ventilation. This demand has stimulated designers and manufacturers of heating and ventilating apparatus to improve their methods and their results.

So far as simple heating is concerned, the modern heating and ventilating engineer finds no difficulty in designing a system, either direct or indirect, live steam or exhaust steam, or hot water, which will carry heat to any distance desired and deliver it in one or many rooms, heating them to 70 degrees or more when the outside temperature is 20 degrees below zero. Even the warm-air or furnace system is capable of accomplishing the same results when reinforced by electrically-driven fans, when the distance is not too great. The only limit that is fixed in heating a building or a group of buildings is the limit of cost fixed by the owner.

DIFFICULTIES OF VENTILATION

The problem of ventilation, however, is a much more difficult one for the designer. It is easy enough to ventilate properly a large single chamber, such as a church, a cathedral, a theater, or a stock exchange, but when a large building of several rooms, such as a public school, or a court house, or a hospital, or a skyscraper office building, is to be ventilated, the problem becomes very complex, and it cannot be said that any general solution of it has yet been found. Each case has to be studied carefully by itself in the light of previous practice, and the record of such practice includes almost as many failures as successes. Many of these failures are due to the parsimony of the owners, who limit the cost to a figure at which it is impossible to provide good ventilation. Others are due to the failure of the architect to call in the advice of competent experts, and still others are due to the imperfect education of the experts themselves, or to their neglect to appreciate the real difficulties of the problem on which they are engaged.

VENTILATING LARGE BUILDINGS

Let us consider for a moment what are the difficulties of heating and ventilating a large building containing many rooms, such as a school house or a court house. The problem to be solved is to keep each room at a temperature of, say, 70 degrees F., and the air of such purity that it contains at no time more than eight volumes of carbon dioxide in 10,000 volumes of air, or twice the amount found in the atmosphere outdoors. The mere heating of each room can be done satisfactorily by direct steam radiation with thermostatic control of the steam supply. The ventilating problem, however, is not so easily solved. Each room should have given to it a quantity of air proportional to the number of persons in the room. The means provided for supplying fresh air to the building is usually either a fan placed in the basement, which pushes the air into the several rooms the air finding its way out through foul-air exits, or else there is an exhaust fan in the attic or on the roof of the building, pulling out of the rooms the air which is admitted from the air-inlet pipes.

In the best modern practice the incoming air is warmed by steam coils in the basement before being allowed to enter the rooms. In some cases there is both a blower fan in the basement and an exhaust fan for foul air at the roof. Between the points of entrance and exit there are at least as many channels or pipes for the air to travel in as there are separate rooms. The areas of these pipes and their resistances, due to friction, to right-angle bends, dampers, etc., may be calculated and adjusted so that when there is still air outdoors and the fan or fans running at a certain speed the air delivered into each room may possibly be the amount calculated by the designer. I say "may possibly" and not "will certainly," because it is scarcely possible to design a system consisting of a large number of pipes, varying in size, diameter, and length, leading from an air reservoir to another reservoir at lower pressure, in which each pipe will deliver its due proportion of air.

There is bound to be more or less "short circuiting" under the most favorable circumstances.

VARIATIONS IN THE REQUIREMENTS OF AIR PIPES

The next trouble is that we have the pipes so perfectly designed that each pipe, under the best circumstances, will deliver its own calculated proportion of air, then the circumstances for which the pipes are designed are bound to vary every hour in the day. Some one of the rooms will have a crowd of people greater than was calculated, and they will remain longer in a room, polluting the air. Some one opens a window to let out the foul air and let in fresh, and immediately the whole circulating system is disarranged and thrown out of balance. If there is a wind blowing into the room it will blow back the incoming air supply and tend to increase the air supply of all the other rooms in the building. If, on the other hand, there is still air outside and the air from the heating coils enters the room under pressure, the opening of the window will establish a short circuit for this air to go outside by the window instead of going through the exhaust flues to the roof. Some air will enter the room on that account, and one or more of all the other rooms of the building will be robbed of their proper supply. The room that is thus deprived of its proper supply will then become not only foul, but overheated, and a window will have to be opened in it in order to cool and purify the atmosphere, and this will further disarrange the ventilating system. What is needed is such a system as will not be put out of balance when the doors or windows are opened in any one or more rooms of the building.

NO MEANS TO REGULATE PURITY OF AIR

We have means of automatically regulating the temperature of a room, but we have no means of automatically regulating the purity of the atmosphere in it. Not only this, we have as yet no means of even indicating the purity of the atmosphere in any convenient manner, such as we have in the thermometer for indicating its temperature, and in the aneroid barometer for indicating its pressure. An occupant of a room is not likely to notice that the atmosphere in the room is impure until the impurity is more than double what should be allowed, and even the chemical determination of the condition of the atmosphere is a matter of no little difficulty.

EFFECT OF ACTION OF WIND

Another difficulty with all methods of ventilation is that while air is so easily moved by a very light pressure in sufficient quantity to provide ventilation for any room, this pressure is apt to be overcome by the action of the wind on one side of the building, entering through crevices or cracks or through the porous walls, so that while the atmosphere is quiet outdoors the ventilating system may work all right, but when there is a wind pressure against the building it may be thrown out of balance.

The various complex problems of heating and ventilating are gradually being solved and the difficulties overcome by the method of trial and error. Now and then a building is erected which gives satisfactory results, and the methods used in it are copied in other buildings. Again, another system is found ocasionally to fail, and as the causes of failure become understood they are avoided in future designs. "Rules of thumb" are still in vogue for proportioning the sizes of every detail of heating and ventilating apparatus, from the size of a grate surface and the rate of combustion of coal, to the speed at which ventilating fans should be driven and the area of the pipes and registers from which they shall discharge their air. Sometimes formulas are used which are apparently based upon physical theories, but each of these formulas contains one or more empirical coefficients whose values are more or less uncertain. By the use of these formulas and rules of thumb, supplemented by practical experience, the heating and ventilating engineer is enabled, when he is not limited by cost of apparatus, to provide a fairly satisfactory heating and ventilating system for almost any building; but the best of such systems are not automatic; they require constant and faithful attention on the part of the operatives in charge of them, and they are expensive, both in cost of apparatus and in cost of fuel.

A VAST FIELD FOR RESEARCH

There is a vast field for research to determine more accurate values of the coefficients to be used in our formulas and to find out how it is possible to ventilate a building with just enough air to maintain the standard of purity at what it should be, without discharging from the building uselessly a great quantity of hot air over and above that required for the necessary ventilation.

Why are such tests and researches not made? The answer is that all our heating and ventilating engineers are too busy to make them. We have no national laboratory of research in which they can be made, and the imperfectly equipped laboratories in our technical colleges are scarcely as yet prepared to undertake such researches. We have had a Committee on Tests in this society for the last ten years but it has done practically nothing, the reason always given being lack of time and lack of funds.

HEATING AND VENTILATING LITERATURE

The literature on the subject of heating and ventilation is not yet extensive, but it is growing at a fairly rapid rate. We have but few standard text-books, but we

have the annual volumes of this society and of the younger British society. We have also a few trade and technical journals devoted to the subject, and the leading engineering periodicals occasionally contain valuable articles illustrating the most recent practice. A systematic and scientific digest of the literature of the last ten years is greatly needed, but the person who has both the ability and the time to make such a digest is not easily found. It might prove a good investment for one of our publishing houses to find such a man, pay him for his time, and get him to write a thorough treatise, covering both theory and practice.

TECHNICAL COLLEGES TAKING UP HEATING AND VENTILATING

The scientific study of heating and ventilating has been begun in a few of our technical colleges as a branch of the general subject of mechanical engineering, but the greatest amount of time that can be devoted to it is two or three hours a week for one half-year. An excellent description of such a course is given in the paper by Prof. J. D. Hoffman, of Purdue University, published in the 1903 volume of our Proceedings. Not much practical work or research can be expected from so brief a course, but great good from it will ultimately result to the profession from its giving to a large number of engineering graduates each year an introduction to the subject and some knowledge of its fundamental principles on which they can build later when they enter into practice. It also tends to the diffusion of knowledge on the subject among the general public and to the increase of public sentiment in favor of improvement in ventilation.

It is to be hoped that before long some engineering college may find it convenient to offer a post graduate course in heating and ventilating to a few mechanical engineering graduates who shall have had a year or two of practice in the heating and ventilating business before entering upon the course.

PROFESSION OF ARCHITECTURE SHOULD BE DIVIDED

The architectural profession is being gradually educated to the advisability, or the necessity, either of employing consulting engineers on all important work, or else of architects associating themselves with engineers as partners. The time seems to have arrived when the profession of architecture should be divided, just as the engineering profession has been. We no longer have general engineers who are competent unaided to undertake the design of every detail of a plant which shall include in it matters belonging to several branches of engineering, such as civil, mechanical, and electrical; we no longer have railway engineers, but engineers of maintenance of way, of motive power, and of electrical transmission and motive power. So also we should have artist architects, who could revel in designs of exteriors and interiors, and engineer architects; and these last should be divided into structural engineer architects, who would design the foundations and the superstructure; and architectural mechanical engineers, who would have to do with boilers and chimneys, pumps and piping, elevators, electric lighting, and heating and ventilation. The ideal arrangement, of course, would be the association of these three kinds of men in partnerships, styled "architects and engineers." It ought to be generally recognized that no good artist can be an engineer, and no good engineer an artist.

NEW YORK AND PENNSYLVANIA VENTILATION LAWS

The society is to be congratulated on the fact that, due to its effort, two states, New York and Pennsylvania, have passed laws leading toward the securing of a reasonable amount of ventilation in schools hereafter to be built in these states. It is to be hoped that the society will continue its effort in this direction and that other states will soon follow the example set by New York and Pennsylvania.

The Pennsylvania law states that no school-house costing in excess of $4,000 shall be erected by any board of education or school district in the state until the plans and specifications shall show in detail the proper heating, lighting and ventilating of the building. "School-houses shall have in each class-room at least 15 square feet of floor space and not less than 200 cubic feet of air space per pupil, and shall provide for an approved system of ventilation, by means of which each class-room shall be supplied with fresh air at the rate of not less than 30 cubic feet per minute for each pupil."

The New York law applies to school-houses erected in cities of the third class, incorporated villages, and school districts, and to additions to such school-houses costing more than $500. It provides that the plans and specifications shall show in detail the ventilation, heating, and lighting of such buildings, and that they shall be submitted to the Commissioner of Education, who shall not approve them "unless the same shall provide at least 15 square feet of floor space and 200 cubic feet of air space for each pupil," and "unless provision is made therein for assuring at least 30 cubic feet of pure air every minute per pupil, and the facilities for exhausting the foul or vitiated air therein shall be positive and independent of atmospheric changes." These two laws are good as far as they go, in requiring that plans and specifications for school-houses shall provide for an approved system of ventilation by means of which 30 cubic feet of air per minute shall be supplied to each pupil. Something more is needed,

however, and that is an investigation by engineers of the board of health of each state to discover whether or not all the class-rooms in schools built under the specifications of these laws are actually supplied with the 30 cubic feet of air per pupil in every minute, independent of conditions of wind or weather. These engineers should also report upon the best means of measuring the air supply to each class-room, and the best means of regulating the supply in different class-rooms in case any one of them should be receiving more or less than its proper supply.

The chemists and physicians of the boards of health might also do a valuable service for the rising generation in making observations and experiments to determine whether or not the introduction of 30 cubic feet of air per minute per pupil is sufficient to keep the purity of the air at the desired standard in all parts of the room during the last two hours of the school period, and whether this amount of ventilation is sufficient to prevent that depression of vitality with tendency to ill health which follows the long continued breathing of a slightly foul atmosphere.

VALUE OF QUESTION BOX

The society has done a great deal of good work during the last 12 years, but it is only a mere beginning. I have already hinted at some of the work that lies before us. There are other things yet to be done. Let us double our present membership in the next five years. It can easily be done. Let us encourage the young men especially to join. Ten years hence they will be the leaders of the profession. Let us have our mid-summer meetings as far west of New York city as possible, to let people know that we are a national society. Let us start a "question box," following in a mild way the example of the Ohio Gas Light Association, which has just issued its third question box annual volume, a book of 900 pages, containing no less than 4,920 answers contributed by 519 contributors to 567 questions. If we could have a question box of only one-tenth this size what a valuable thing it would be. Our Committee on Furnace Heating started a series of questions nearly a year ago, but only two replies have thus far been received. It is a rather slow beginning, but we hope for better results in the coming year. It takes time to get engineers in the habit of devoting a small portion of their valuable time to the public service without compensation, but if the Ohio Gas Light Association can get 519 different people to answer its questions on such a subject as gas, why cannot we get one-tenth of that number on the more vital subject of fresh air—a subject that is of the utmost importance to the health of the community?

Let the good work of the society go on, and we shall soon have an organization of which we may be proud, not only on account of its numbers, its resources, its professional standing among other scientific societies, but above all on account of the work it has done and is doing for the advancement of the science and the art of heating and ventilation, and for the benefit of the health of our fellow-men.

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President Kent's address, being out of the usual routine, was followed with close attention by those present and his remarks were warmly applauded. At the conclusion of his remarks, Secretary William M. Mackay presented the following report:

### Secretary's Report

At our last annual meeting our membership was composed of 198 members, 1 honorary member, 16 associates, and 5 juniors, or a total of 220 members of all grades. During the year we have added 30 members, 3 associates, and 3 juniors. Four members have been dropped from the roll for non-payment of dues, 6 members and 2 associates have resigned, and James Curran, a valuable member of our society, who was elected December 9, 1901, died October 27, 1905. Our present membership is 217 members, 1 honorary member, 17 associates, and 8 juniors, or a total of 243 members of all grades, making a net increase of 23 during the past year.

The financial affairs of the society are in good condition. At the last annual meeting there was a balance in the hands of the Treasurer of $684.19. We have received from all sources during the past year $2,542.75, which, with the balance on hand, made a total of $3,226.94 available. The total expenditures amounted to $2,593, leaving a balance in the hands of the Treasurer of $633.94. There is a balance owing from members, for dues, etc., and from newly elected candidates for membership for initiation fees and dues amounting to $1,150, which, with the balance on hand, amounts to $1,783.94. The principal reason for the large amount owing is that the last ballot was delayed and $485 of this only became due on the 15th inst., so that the actual old balance owing by members is $665, or about the same as last year.

We have no unpaid bills except those in connection with the present meeting, which have not been presented. The members dropped from the rolls during the year owed the society a total of $120.

The 1904 Proceedings were sent to the members in December, 1905, and the 1905 Proceedings are now being edited and corrected and will be forwarded to the members as soon after this meeting as possible. The cost of the editing and printing of these Proceedings will amount to about $800.

The society held a very successful meeting at Chicago, Ill., July 7 and 8, 1905, being the most largely attended summer meeting we have ever held.

The Treasurer's report showed a balance on hand of $633.94, as stated in the Secretary's report.

Mr. James Mackay presented the report for the Board of Governors, as follows:

### Report of the Board of Governors

Your Board of Governors met and organized January 21, 1905, appointing a Committee on Finance, Membership, and Publication, and an Executive Committee. The various committees have given careful attention to their duties and the board has met as often as was found necessary during the year. We are able to report an increase in membership, and the financial affairs of the society are in good condition, with sufficient funds on hand to pay for the publication of the 1905 volume, which has been delayed, but which will be forwarded to the members as early this year as possible. As a number of our members in arrears owe two years' dues, in accordance with the constitution this disqualifies them and prevents us from placing their names in the 1905 directory. The usual custom has been not to drop the names from the rolls until February 1, when they would owe $30, so it was decided not to publish the pocket list of members until after the close of this meeting, when it will be correct, more valuable to the members, and have no unqualified members in it.

Respectfully submitted: William Kent, chairman; R. P. Bolton, vice-chairman; C. B. J. Snyder, B. H. Carpenter, B. F. Stangland, James Mackay, A. B. Franklin, J. C. F. Trachsel, and W. M. Mackay, secretary.

The report of the Committee on Compulsory Legislation, read by Mr. B. H. Carpenter, called attention to the law that had been enacted in New Jersey over a year ago, which, owing to the fact that it had been added to a general school law, had only recently come to the committee's attention. This law is fully as stringent as those now existing in New York and Pennsylvaia, as well as the Massachusetts regulations. (The New Jersey law will be found on another page of this issue.) The committee reported that Mr. T. J. Waters, of Chicago, had worked with the committee in compiling a compulsory ventilation law for Illinois. It was introduced too late for action last year, but will be pushed at the next meeting of the legislature. Efforts to push through a bill in Michigan are also under way.

### Other Reports

Reporting for the Committee on Standards, Mr. J. J. Blackmore said it had been found impracticable to adopt a proposed list of abbreviations in heating and ventilating work, as the art was not yet sufficiently advanced. Regarding a proposed list of standard sizes for steam pipes, Mr. Blackmore said the committee had come to the conclusion that no standard was possible at present that would be entirely satisfactory to the society, owing to the fact that there are so many different systems in use.

Mr. B. H. Carpenter read the report of the Committee on Tests. While not able to make any report on tests made, the committee suggested that members should inform it as to what tests it is desirable to make, and outline manner in which such tests could be made. It was also suggested that the committee be made the depository of tests.

Following the reading of this report the following tellers were appointed to count the votes cast for officers: Frank G. McCann, J. J. Wilson, and N. P. Andrus.

#### NEXT MID-SUMMER MEETING

Under the heading of new business, the place for holding the next mid-summer meeting was discussed. Invitations from Milwaukee, Chicago, Denver, Atlantic City, Columbus, and London, England, were announced. The general sentiment proved strongly in favor of a meeting in the Middle West, and upon the renewal of the discussion at a later session a formal resolution was passed to the effect that it was the sense of the society that the mid-summer meeting should be held in some western city. The choice under the constitution rests with the Board of Governors.

#### STANDARD SIZES FOR STEAM PIPES

Another subject taken up at this time was a suggestion by Mr. James A. Donnelly that an invitation be extended to heating engineers to submit lists of standard sizes for steam pipes as followed in their practice. This suggestion evoked considerable discussion. Mr. John Gormly suggested that a committee be appointed to work with that of the Master Fitters' Association. It then developed that the idea was to collect data on the sizes of steam pipes as now used in different sections of the country. That done, the society would be prepared, possibly, to establish a series of standard sizes for given conditions. The discussion finally resulted, at a later session, in the appointment of a special committee to collect data on steam mains and returns.

#### RESPONSIBILITY IN THE ERECTION OF HEATING APPARATUS

Another item belonging more especially to the business portion of the meeting was the discussion of the topic: "Why should a steam-heating contractor who is working under the plans and specifications of an expert consulting engineer, be compelled, under his contract, or any clause in the specifications, to guarantee the working of his job, or the temperature, or the delivery of a specified amount of air for the heating or the ventilation of any room or structure?

Mr. E. Rutzler said some vigorous words on this topic, citing a recent experience of his own in which he had signed

a contract containing this "joker," whereby he was made responsible for the working of the plant. Others spoke in the same vein, the opinion prevailing that the designing engineer should take the responsibility for the working of the plant, provided his conditions were properly complied with, and that the contractor who signed a contract with this "responsibility" clause added had no one to blame but himself if compelled to make good any defects in the design. Mr. W. M. Mackay called attention to the fact that many contracting engineers make it a rule to add a certain percentage to their bids in case they are asked to assume the responsibility.

## FIRST DAY, JANUARY 16—EVENING SESSION

### Heating and Ventilating the Main Auditorium of the Broadway Tabernacle

(This paper, by C. Teran, was presented in our January issue.)

DISCUSSION

PRESIDENT KENT—In heating up this building, was not the exhaust fan stopped and the air circulated round and round?

MR. TERAN—No, sir.

PRESIDENT KENT—Did you discharge the hot air out of the building during the time you were heating it?

MR. TERAN—We found the best way was to run the exhaust at the same time we blew the air in, because we could not keep the hot air down. The hot air would naturally rise and take a much longer time to heat the lower portion of the room.

PRESIDENT KENT—You could turn the exhaust pipe and make connections with it into the inlet pipes and make the circulation round and round?

MR. TERAN—That could be done, but there would be the temptation to do it when the audience was seated.

PRESIDENT KENT—How long would it take to heat that building on a very cold night, say down to zero?

MR. TERAN—We haven't had any occasion of that kind yet. That is very cold weather; but with mild weather and the temperature not very cold, it does not take longer than a half hour.

MR. B. H. CARPENTER—What proportion of air was introduced from the front of the stage, or pulpit, and what proportion from the seats?

MR. TERAN—I hardly think I could give you the exact proportion, but from the number of registers I should think not more than 50%, on the side of the pulpit. There is more from the side of the pulpit than from the other side.

MR. BARRON—I think it is accepted that the floor registers are objectionable in an otherwise very good design.

MR. TERAN—The floor registers we used were placed in front of very large windows to counteract this large surface draft. The velocity is very low and as they are in the aisles back of the seats, the air does not come directly against the people there. The registers are directly in front of the windows. There are some registers that are placed in the front gallery on the steps, and they are objectionable, but there was no other place to locate them.

PROF. R. C. CARPENTER—Wouldn't it be possible to provide some drawing in connection with this paper? It seems to me the paper would be greatly enhanced by a few drawings showing the internal arrangement of the apparatus.

(*Drawings of Mr. Teran's plans were published in our January, 1906, issue.*—ED.)

Referring to an inquiry regarding the temperature of the incoming volumes of air, Mr. Teran said: We made preliminary tests to get the velocities wanted, and the present velocities are about what we figured they would be. The temperature of the incoming air varies, of course, with the outside temperature.

The temperature of the church is controlled by a thermostat at 65 degrees, I think. We made some tests on account of trouble we found with drafts, and found where the trouble came from. Underneath the side galleries are some large registers, the velocities of which were intended to be 600 cubic feet, and it seemed that the registers were too close under the side of the aisles. At first we thought the air was coming from the galleries. To find the trouble we had to make some smoke tests, and with a large amount of smoke in the building we found the draft was coming from underneath, the air striking the ceiling of the gallery and being deflected downward.

MR. FRANKLIN—In reference to the proportion of air in these different inlets, Mr. Teran says: "The heat registers are placed from eight to twelve feet above the main auditorium and gallery floors." About what proportion of the air is admitted to the room either on the eight-foot level or the twelve-foot level?

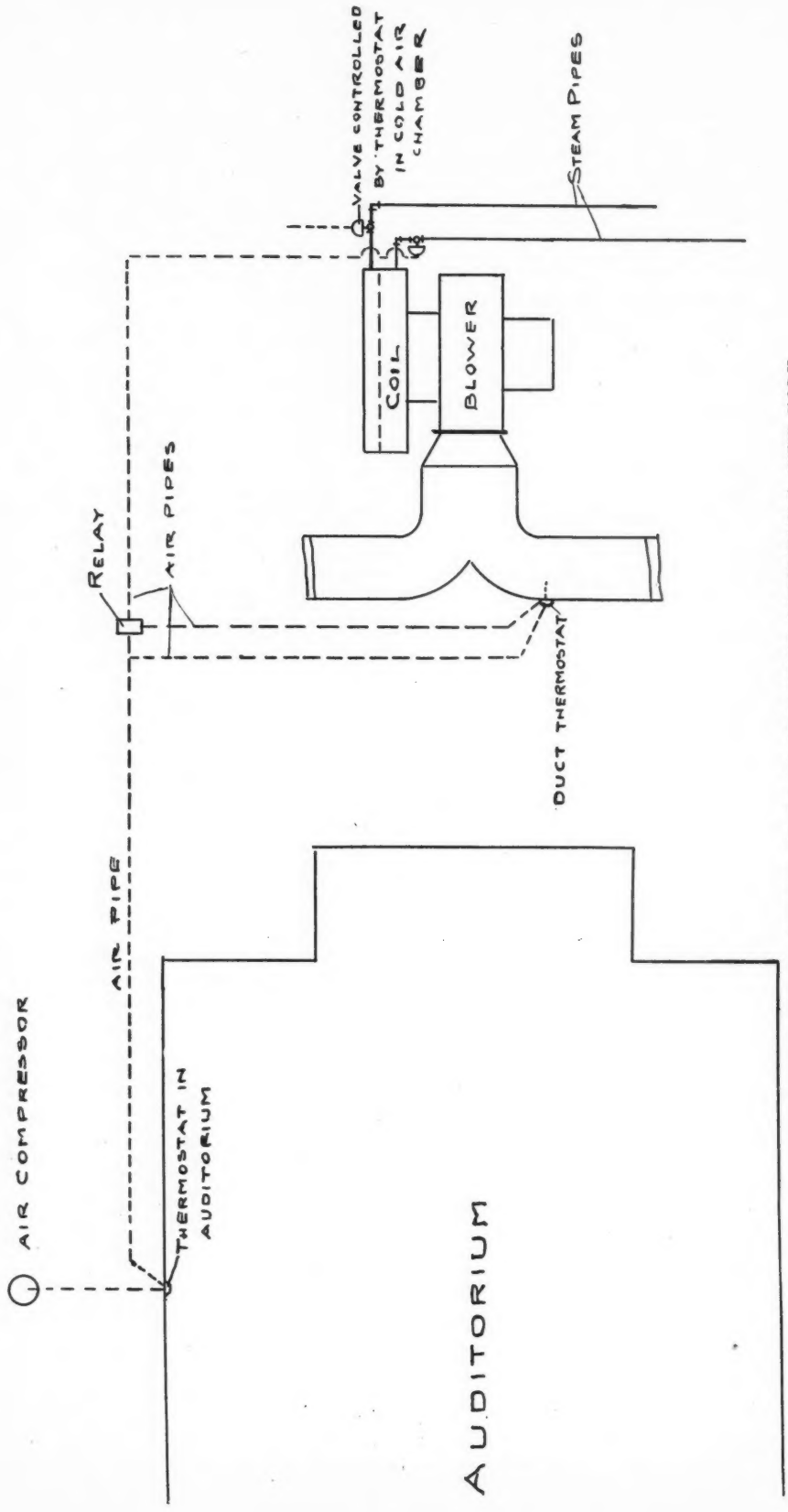
MR. TERAN—We have no proportion of distribution except that we did try to introduce as much air as possible on the side of the pulpit, and the rest of it wherever there was a cooling surface. The distribution is done more by the exhaust than by the incoming air.

MR. FRANKLIN—The gentleman says "top inlets." Does he mean by "top inlets" those inlets that come eight feet above the floor or twelve feet about the floor?

MR. TERAN—Both eight and twelve feet.

MR. FRANKLIN—Then may I ask the elevation of the inlets at the side of the pulpit?

MR. TERAN—They are the same as the others. The ones underneath the side




ARRANGEMENT OF THERMOSTATS IN BROADWAY TABERNACLE, NEW YORK

galleries—there are registers on each side —are about ten feet from the floor. Above the gallery there are four registers on each side. Some are eight and some ten feet from the floor.

MR. FRANKLIN—What is the approximate area of these plates?

MR. TERAN—Two feet square.

MR. J. A. HARDING—With reference to the exhaust on the main floor, about what proportion of the entire area of the auditorium is provided with this exhaust? Is air exhausted from the entire area of the floor?

MR. TERAN—These exhaust openings are at the seats. There are two main aisles and also two side aisles, and therefore the distribution is over the entire floor.

MR. HARDING—Does the exhaust cover all the central portions of the auditorium, or only the side aisles?

MR. TERAN—Both.

PRESIDENT KENT—Is there a down current from the large window or an up current?

MR. TERAN—There is an up current.

PRESIDENT KENT—What becomes of the other 20% that is not taken care of by the exhaust?

MR. TERAN—Leakage takes care of that.

MR. BARRON—There is a portion of the author's paper that really presents something new in regard to automatic regulation. He says "when the apparatus is started in operation the air is introduced at as high a temperature as the heater coil will heat it, until the temperature in the auditorium has reached the maximum required. The air is introduced tempered only until the temperature in the auditorium falls below normal, when the air is again heated to a higher temperature to supply the loss." As I understand it, he uses the heater as a tempering coil for the preliminary heating of the building, and as soon as the building is warmed the thermostats close. This is something new to me.

MR. TERAN—This is not particularly new, except probably as applied to churches. In other buildings it has been done.

(*The author drew a sketch of the thermostatic arrangements, which is presented herewith.*)

PRESIDENT KENT—If the auditorium gets hot, will the thermostat shut off the steam itself?

MR. TERAN—The auditorium thermostats regulate the flow of steam and let the air through to shut off the steam valve. As soon as that valve is closed and the air cools to 65 degrees, the other thermostat will open the valve and permit it again to flow.

PRESIDENT KENT—When will that duct thermostat close it?

MR. TERAN—It would close it as soon as the air again gets above 65 degrees.

MR. HARRISON — Wherein is the point of advantage in having this thermostat control the main coil and admitting steam to all coils at once and shutting it off all at once, rather than in dividing up and controlling the tempering coils by sections? Suppose you divide the coil into sections, then you would have a certain temperature in your hot-air chamber with a by-pass damper. You have mixing dampers controlled by thermostats in your auditorium. What is the special advantage in the system adopted, rather than that in which mixing dampers are used?

MR. TERAN—The objection to mixing dampers is that the air does not get well mixed. We have a certain amount of hot air and cool air at the same time, and it seems they don't mix well. It is also cheaper to arrange it the way we have done.

MR. HARRISON—Is not one of the objections to the mixing damper with your system of control that the damper must be in one position or the other, and when there is cold air you get too much cold air, and so deliver air into the auditorium at a low temperature, possibly as low as that tempering coil allows it? Now, if you have the mixing damper that will give the exact position desired would it not be preferable?

MR. DRISCOLL—The thermostat operates at 65 degrees. It seems to me the temperature in the warm-air duct would be 65 degrees and the temperature of the auditorium would not go above that at any time.

MR. TERAN—It does, when the outside temperature is very mild. The heat given out by the audience will make it too warm and very unpleasant.

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## Some Features of the Heating and Ventilating System in the Bellevue-Stratford Hotel, Philadelphia.

(This paper, by William G. Snow, was published in our January issue.)

DISCUSSION

PRESIDENT KENT—What is the use of these 297 fireplaces?

MR. SNOW—In a hotel of this character the guests demand the luxury of open fires. They provide, also, for the removal of smoke. In the main lobby, four-foot logs are burned in the fireplaces.

PRESIDENT KENT—Can you explain how these revolving doors can take in cold air and deliver it as warm air?

MR. SNOW—These are circular doors and the admission of air above the doors has nothing to do with the doors. In a building of this character it is difficult to find space for radiators, and by placing our radiation over these doors we do not interfere with the decorations or other

arrangements. The coils are located above the top of the door.

PRESIDENT KENT—The door still gives a supply of cold air?

MR. SNOW—It enabled us to put our radiation where it would be effective. We were prevented from placing it in the corridors, in the usual place on the floors. I never saw radiation put in that location before, but it has worked out successfully.

MR. BARWICK—Do you get the fresh air through the ceiling of the Van Kannell door?

MR. SNOW—We get fresh air from the outside, through registers provided above the top of the door.

MR. BARRON — Regarding direct-connected motors, we all know direct-connected motors with a large fan cost more money than a high-speed belted motor. I would like Mr. Snow's opinion on direct-connected motors on large fans, such as he mentions using in this building.

MR. SNOW—On general principles it is much more satisfactory to have a belted motor, for all you have to do, if there is any difficulty about the air supply, is to change the size of the pulleys. But, on the other hand, there is more or less belt slippage and attention required. Another point we all appreciate in laying out work of this character, is lack of space to get any reasonable distance on center for belts. The calculations have to be right at the outset, with a direct connected rig, or it means a new motor. Wherever we belt and the motor is big enough, if the result is not what we expect it, we simply change the pulley.

MR. BARRON—Does Mr. Snow think, on the whole, that the belted motor is not such a bad thing where you have room to belt it?

MR. SNOW—Where you have one or two fans in a church, school building or public building, that is a different proposition from one where you have twenty odd fans, as in this building. The attention required for twenty belted motors is considerably more than that required by twenty direct-connected.

MR. QUAY—Where you can get space for a proper distance for a belt, there is a gain, where you have to carry the fan on a steel structure.

MR. SNOW—In the case of this building we had four 7-foot fans, one 6-foot fan, and several other fair-sized ones. In the case of only one of these could we have used a belt rig. This was due to lack of space.

MR. R. R. M. CARPENTER—I notice you say you placed two valves on each boiler connection. Why was that done?

MR. SNOW—For the purpose of testing. There was a drip-valve between the two. This gives double protection.

PRESIDENT KENT—In working out the radiation, did you make any allowance for the cubical contents?

MR. SNOW—The reason I expressed it as I did was, that I have a rule of my own. To the heat lost by transmission per hour, I add, in rooms of one exposure, a number of heat units equal to two-thirds of the cubic contents. For corner rooms, I add to the transmission lost a number of heat units equal to the cubical contents divided by 3.

PRESIDENT KENT.—How much would that be?

MR. SNOW—I cannot say positively.

MR. GORMLY—In this building there are 566 bath-rooms. I would like to have an expression of opinion as to whether it is not considered dangerous to take air from a point where there are so many rooms discharging foul air.

MR. SNOW—The purest air comes from the vicinity of the roof. We endeavored to keep, and always do, the level of the intake below that of the smoke outlet or other outlets. These outlets, discharging at a high velocity, carry the smoke and foul air up into the air. The intake is at a lower level, so that there is very little likelihood of one mixing with the other.

In response to an inquiry regarding the capacity of the hot-water generators, Mr. Snow said that these were furnished by the plumber, so that he did not know how the proportions were figured. He said, however, that the capacity of the tanks had proved adequate and supplied not only the guests, but the kitchen, although it was originally the intention to put in a third generator for the kitchen.

MR. QUAY—Mr. Snow figures up the additional power required to force warm air down from the attics to the rooms, and I think it is interesting to all. I want to ask if Mr. Snow has any figures relative to the upward tendency of the air in the shaft.

MR. SNOW—I have no figures, but I will state that we did not have to make any changes whatever in the arrangement. Our apparatus gave the required amount of air, as we expected it would. A speed of 220 revolutions per minute delivered about 30,000 cu. ft. of air per minute, with 25 H. P. motors, and when tested we found that we had 10% to 20% leeway. On the 7x4 foot fans in the basement we put 20 H. P. motors. The fans discharged into a 300-foot duct, and worked all right.

PRESIDENT KENT—Referring to the hot-water generators, it is possible with very small tanks to supply an almost unlimited amount of hot water, where you have a proper arrangement for bringing live steam into the water.

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Mr. Albert A. Cary then presented the following address in connection with the bi-centennial of the birth of Benjamin Franklin.

## Benjamin Franklin as a Heating and Ventilating Engineer

By Albert A. Cary

The American Society of Heating and Ventilating Engineers happened by some strange coincidence to hold their present annual meeting on January 17, 1906.

Two hundred years ago upon this same date, Benjamin Franklin was born, and upon this bi-centennial anniversary of his birth it seems but fitting that some recognition should be given to this great man by this society, as he was undoubtedly the originator of what has been commonly recognized as American practice in heating and ventilation.

During the 84 years of his busy life he loaned himself to many pursuits, including literature, politics and science, and he was widely acknowledged, both at home and abroad, as being a master in all of these directions.

### Invention of Pennsylvania Fireplace

The part of his scientific investigations which appeals to us the most is his invention between the years 1740 and 1745, of what he called the Pennsylvania fireplace, which excellent design was afterwards imitated and changed until, in many cases, its original design and principle was entirely lost sight of, and we find many of these so-called improvements bearing the name, even to-day, of the Franklin stove.

The fact that fuel was growing scarcer and dearer every year caused Franklin to revolt against the fearfully wasteful manner in which such fuel, principally wood, was being used, and his investigation caused him to make a careful study of all the different methods of house heating, and after studying their various faults, he was finally led to invent the Pennsylvania fireplace, which resulted in great economy of fuel and in a properly heated room, such as was hardly known at that time, according to the sense that we consider a room to be properly heated to-day.

The real Franklin stove was not the mere iron fireplace which masqueraded under that name, but it was an apparatus which took cold fresh air from the outside of the house and after warming it in passages kept hot by the escaping gases of the fire, it was finally discharged into the room, and this old original Franklin fireplace, had it been enlarged and slightly altered and placed in the cellars of our houses, certainly would have become the prototype of all our hot air furnaces.

Mr. Cary told of the negotiations that finally led up to the publication of Franklin's works on philosophy, politics and morals, which were brought out in London in 1806, and suggested that, as a fitting memorial, that portion of his works in which Franklin treated of the subject of heating and ventilating be reproduced in the society's transactions. For this purpose Mr. Cary expressed his readiness to loan an original copy of this book of Franklin's.

### Franklin's Idea of Heat

Regarding Franklin's idea of the theory of heat, Mr. Cary continued:

Some of the arguments offered by Dr. Franklin's description are extremely interesting on account of his treatment of the theory of heat.

At that time the materialistic theory of heat was generally recognized, which theory considered fire as a substantial material having weight and substance instead as being considered as merely a mode of motion in accordance with our present theories.

### The Holland Stove

Franklin's description of the Holland stove and his comments concerning it show his clear conception of the manner in which stoves of this type heat a room. He states:

"The Holland iron stove, which has a flue proceeding from the top, and a small iron door opening into the room, comes next to be considered. Its conveniences are that it makes a room all over warm; for the chimney being wholly closed, except the flue of the stove, very little air is required to supply that, and, therefore, not much rushes in at crevices, or at the door when it is opened. Little fuel serves, the heat being almost all saved: for it rays out almost equally from the four sides, the bottom and the top, into the room, and presently warms the air around it, which, being rarefied, rises to the ceiling, and its place is supplied by the lower air of the room, which flows gradually towards the stove, and is there warmed, and rises in its turn, so that there is a continual circulation till all the air in the room is warmed. The air, too, is gradually changed, by the stove door's being in the room, through which part of it is continually passing, and that makes these stoves wholesomer, or at least pleasanter than the German stoves, next to be spoken of. But they have these inconveniences: There is no sight of the fire, which is in itself a pleasant thing. One cannot conveniently make any other use of the fire, but that of warming the room. When the room is warm, people, not seeing the fire, are apt to forget supplying it with fuel till it is almost out, then, growing cold, a great deal of wood is put in, which soon makes it too hot. The change of air is not carried on quick enough, so that if any smoke or ill smell happens in the room, it is a long time before it is discharged. For these reasons the Holland stove has not obtained much among the English (who love the sight of the fire) unless in some workshops, where people are obliged to sit near windows for the light, and in such places they have been found of good use."

THE PENNSYLVANIA FIREPLACE

He then proceeds to give a description of his Pennsylvania fireplace, as follows:

1. A false back of 4-inch (or, in shallow small chimneys, 2-inch) brickwork is to be made in the chimney, 4 inches or more from the true back; from the top of this false back a closing is to be made over to the breast of the chimney, that no air may pass into the chimney, but what goes under the false back, and up behind it.

2. Some bricks of the hearth are to be taken up, to form a hollow under the bottom plate; across which runs a thin, tight partition, to keep apart the air entering the hollow and the smoke, and is, therefore, placed between the air hole and smoke holes.

3. A passage is made, communicating with the outward air, to introduce that air into the fore part of the hollow under the bottom plate, whence it may rise through the air hole into the air box.

4. A passage is made from the back part of the hollow, communicating with the flue behind the false back; through this passage the smoke is to pass.

The fireplace is to be erected upon these hollows by putting all the plates in their place and screwing them together.

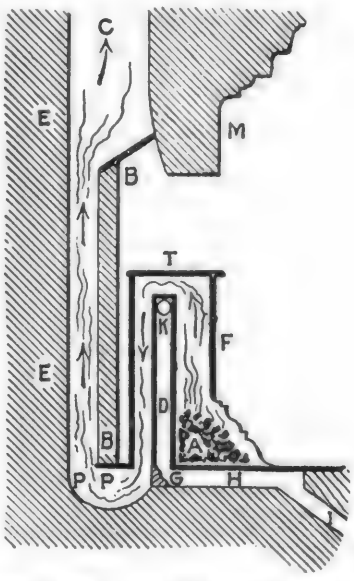
Its operation may be conceived by observing the plate entitled "Profile of the Chimney and Fireplace."

*M* The mantel-piece, or breast of the chimney.
*C* The funnel.
*B* The false back and closing.
*E* True back of the chimney.
*T* Top of the fireplace.
*F* The front of it.
*A* The place where the fire is made.
*D* The air box.
*K* The hole in the side plate, through which the warmed air is discharged out of the air box into the room.
*H* The hollow filled with fresh air, entering at the passage *I*, and ascending into the air box through the air hole in the bottom plate near.
*G* The partition in the hollow to keep the air and smoke apart.
*P* The passage under the false back and part of the hearth for the smoke.

The arrows show the course of the smoke.

The fire being made at *A*, the flame and smoke will ascend and strike the top *T*, which will thereby receive a considerable heat. The smoke, finding no passage upwards, turns over the top of the air box and descends between it and the back plate to the holes in the bottom plate, heating as it passes, both plates of the air box, and the said back plate: the front plate, bottom and side plates are also heated at the same time. The smoke proceeds in the passage that leads it under and behind the false back and so rises into the chimney. The air of the room, warmed behind the back plate, and by the side, front and top plates, becoming specifically lighter than the other air in the room, is obliged to rise; but the closure over the fireplace hindering it from going up the chimney, it is forced out into the room, rises by the mantel-piece to the ceiling, and spreads all over the top of the room, whence being crowded down gradually by the stream of newly warmed air that follows and rises above it, the whole room becomes in a short time equally warmed.

At the same time the air warmed under the bottom plate, and in the air box, rises and comes out of the holes in the side plates, very swiftly, if the door of the room be shut, and joins its current with the




PENNSYLVANIA VENTILATING FIREPLACE, INVENTED BY BENJAMIN FRANKLIN

stream before mentioned, rising from the side, back and top plates.

The air that enters the room through the air box is fresh, though warm; and, computing the swiftness of its motion with the areas of the holes, it is found that near ten barrels of fresh air are hourly introduced by the air box; and by this means the air in the room is continually changed, and kept, at the same time, sweet and warm.

FRANKLIN'S CONCEPTION OF THE REQUIREMENTS OF VENTILATION

We next come to a paragraph showing his wonderful conception of the requirements of ventilation as well as heating in connection with the use of his stove, and we find in his statements the theories that are commonly accepted to-day, as will be seen in the following quotation:

"In rooms where much smoking of tobacco is used, it is also convenient to have a small hole, about five or six inches square, cut near the ceiling through into the funnel; this hole must have a shutter, by which it may be closed

or opened at pleasure. When open, there will be a strong draught of air through it into the chimney, which will presently carry off a cloud of smoke and keep the room clear; if the room be too hot likewise, it will carry off as much of the warm air as you please, and then you may stop it entirely, or in part, as you think fit. By this means it is that the tobacco smoke does not descend among the heads of the company near the fire, as it must do before it can get into common chimneys."

The requirements in a stove or fireplace to enable one to start a fire, to extinguish it or hold the fire in check so that it may smoulder slowly through the night, and be easily started the following morning, are shown in the provisions shown by Dr. Franklin in his Pennsylvania stove.

By examining the sectional view it must be understood that the upper front part of the stove opposite the letter *F* was only partially closed while the lower part of the stove, shown by the irregular line of moulding extending from the hearth *H*, upward to the straight line *F*, was simply an open space between the two sides of the stove, opening into the room, and into this space the fire-dogs or andirons were placed when the fire was in operation, and under such conditions it is quite difficult to start a fire with a cold chimney, so Dr. Franklin provided an iron shutter which slides up and down the face *F*, like a window shade, so as to partially or entirely close the opening into the room, and thus facilitate the handling of the fire, as stated by him as follows:

"A fire may be very speedily made in this fireplace by the help of the shutter, or trap-bellows, as aforesaid.

"A fire may be soon extinguished by closing it with the shutter before and turning the register behind, which will stifle it, and the brands will remain ready to rekindle.

"The room being once warm, the warmth may be retained in it all night.

"And lastly, the fire is so secured at night, that not one spark can fly out into the room to do damage.

"With all these conveniences you do not lose the pleasing sight nor use of the fire, as in the Dutch stoves, but may boil the teakettle, warm the flatirons, heat heaters, keep warm a dish of victuals by setting it on the top, etc."

POOR PROSPECTS FOR OBTAINING COAL IN THIS COUNTRY

We next come to a most interesting statement by Dr. Franklin which shows the prevailing idea concerning the prospects of obtaining coal for fuel in this country.

At that time the black stone, as it was called in England and Germany, had been dug from pits and was burned to comparatively poor advantage, but, nevertheless, giving off heat as it does, was recognized as possible fuel of the future, and some of this pit coal (as it was called on account of the quarrying methods used for its removal to the earth) was brought over to America, but the idea that any of this wonderful substance could possibly be found in this country was very remote in the minds of those who gave the matter any consideration whatsoever. This is expressed by Dr. Franklin in the following paragraph (referring to country in the north of Europe):

"The mentioning of those northern nations, puts me in mind of a considerable public advantage that may arise from the general use of these fireplaces. It is observable, that though those countries have been well inhabited for many ages, wood is still their fuel, and yet at no very great price, which could not have been, if they had not universally used stoves, but consumed it as we do, in great quantities, by open fires. By the help of this saving invention our wood may grow as fast as we consume it, and our posterity may warm themselves at a moderate rate, without being obliged to fetch their fuel over the Atlantic; as, if pit-coal should not be here discovered (which is an uncertainty) they must necessarily do."

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Mr. Cary's paper was received with applause, and his suggestion to incorporate the extracts from this old edition was, on motion, referred to the Board of Governors. A vote of thanks was also given Mr. Cary.

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### Building Code for New York City

At this point Mr. Gormly arose to call the attention of the society to a clipping from an evening paper regarding a resolution before the Board of Aldermen of New York, to formulate a set of building rules, after conferring with the various interests in the building trade. "They say nothing," said Mr. Gormly, "about the ventilating engineer, and I think something should be done by which our people will be represented in such an undertaking."

This matter was taken up at a later session and a committee appointed, as stated on another page.

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## SECOND DAY, JANUARY 17—AFTERNOON SESSION

### Arrangements for the Ventilation of the Debating Rooms of the New Riksdag's Building in Stockholm and the Results Obtained in This Respect

(This paper, by Wilhelm Dahlgren, Stockholm, Sweden, was read by Mr. B. H. Carpenter and was published in our January issue.)

DISCUSSION

PRESIDENT KENT—I will call attention to the fact that the objections to the downward system are in consequence of draft and not of pollution of the air.

MR. BOLTON—I cannot agree with the attempt made to show that the conclusions reached are conclusive. We are not given any data as to the amount of air. That is an important feature. Another thing is the extraction of air and introduction at the very feet of the occupants of the room. The general practice, in this city at least, I think, is not to do that. Mr. Dahlgren says that some of the members complained of cold feet. When the air is introduced at the end of a seat below the temperature of the room, its tendency is to go against the legs. Neither can we place a positive protection against downward air.

MR. BARRON — The German and Swedish gentlemen seem to have that same old quarrel going on. They want to decide positively whether downward or upward extraction is right. The question will never be answered, because both are right, or both can be made right. I can point to buildings in this city where downward extraction is satisfactory, and also to buildings where upward extraction is satisfactory.

MR. J. A. DONNELLY—Mr. Dahlgren says "the valves in four cylindrical air shafts, proceeding from the hot-air chamber, are so adjusted that the air enters the air-distributing chamber at the temperature and to the amount desired.' On another page he says "its steam valve is controlled from the regulating room." The way the paper reads, not assuming anything, it seems to me the mixing dampers are used for mixing cold and warm air on downward ventilation. It is doubtful if mixing dampers are used in upward ventilation. It looks to me as if it was hardly a fair test to make, for in upward ventilation there are 100 or perhaps more openings in the floor to admit the air, and in downward ventilation, when the current is reversed, the air all comes in at the top through one opening.

Another feature is in the introduction of air from below and the mixing of cold and warm air. Here, again, the outlets underneath the seats are calculated to mix the air coming out so as to get uniform distribution. I do not think, if we were trying downward ventilation we would try to put in hot air with mixing dampers in any such manner as shown here. We would give the air what we would consider a chance, so I do not think the conditions are similar for upward and downward ventilation.

MR. PAYNE—I have been noticing a feature of a ventilation in this room in which we are sitting. I notice the cigar smoke all comes back from the front of the room and seems to have a tendency to come towards the center.

PRESIDENT KENT—The steam coils in the skylights of this room are not in operation and there has always been difficulty in heating the room under those conditions. When the coils are on there seems to be no difficulty, but otherwise there is a downward draft.

MR. B. H. CARPENTER—We have had some trouble with downward ventilation, the main difficulty being to get the temperature even at the different elevations, and I have not been able to find out how to adjust that in all cases. In a church building similar to the Broadway Tabernacle, we had the fresh air coming it at the floor and also going out at the floor. The air was brought in at the ends of the seats towards the aisles. The aisles are wide and the air flowing in had a slow velocity, so that no draft was felt. The floor registers carried the air back to the basement, thence to the ducts and exhaust fans. This system was very successful and people claim it is about the best ventilated room they have ever been in

There is a little movement of air, but not strong in any one way. It probably was not the best arrangement that could be conceived of, but it was the best we could do under the circumstances. We preferred to have more air introduced at a higher point, but could not because the walls were partly up when the matter was turned over to us. We did introduce a large amount of air at the pulpit, flowing towards the rear of the room.

In school houses we generally bring the air in at an upper level and exhaust it at a lower level. We do not have trouble from drafts, but we are not always able to keep the temperature at the floor equal to that higher up. But why it occurs in some buildings and not in others, though similar, we are unable to figure out. Now and then we have found that the foul-air fan is pulling too strongly and creating a draft in that way.

MR. WOLFE—I am very much in favor of downward ventilation. Mr. Dahlgren's paper fails to state that any tests were made of the purity of the air. In downward ventilation, you introduce the air—I am speaking more particularly of warm air—at a high level, which in entering naturally stretches itself across the ceiling and naturally seeks the cold surface of the outer wall. The trouble with nine-tenths of the buildings in which complaints are made of cold feet, etc., is not due to the ventilating arrangements, but from the window drafts, due to poor construction. In the ordinary small building the air will be more evenly distributed and you will get a more even temperature with downward than with upward ventilation.

When I was in practice in Massachusetts I looked at a building equipped with upward ventilation that was said to be

the best air-supplied building in the state. Air was introduced at the floor line at the rate of about 45 cubic feet per capita per minute. The air in the room was as bad as air could be. It was introduced at the floor level and taken out at the floor level, and there was no reason why it should circulate.

### New Jersey's Ventilation Law

At this point the proceedings were suspended a moment to enable the ventilation law for New Jersey to be read. This law is incorporated in the school laws of New Jersey and, although it passed the Legislature over a year ago, it had not previously been brought to the attention of the society. A copy of the statute was sent to the meeting by Mr. Thomas B. Cryer, the ventilation clause of which will be found on another page of this issue.

### Report of the Committee on the Collection of Data on Furnace Heating

(This report was published in our January issue.)

DISCUSSION

MR. CHEW—Since the printing of the report a non-member of the society has sent us a set of plans and a partial answer to come of the questions asked by the committee. These plans show a system of heating not in general use by any manner of means. However, it may bring out two points. I don't suppose the system will ever succeed here, but the basis of it is a large cellar main. If there are four rooms to heat, instead of running four separate pipes, with four risers, this system provides for one large main equivalent to the required area of each one of the risers. There is another thing in connection with this plan. In the last few years the register manufacturers are entitled to be complimented upon the departure from the old register which was used in connection with partition flues in particular, which cut off a good portion of the effective area. In this system, a new type of side-wall register and a new type of partition was used; instead of the 4x16-inch flue, a 9x12 or 15x18 inch flue, whatever the studding will allow you to get.

MR. BOLTON—There is one feature that does not appear to have been dwelt upon, and some prominence should be given to it; that is the matter of intakes. I live in a furnace-heated house and have effected one change in connection with my own furnace which has been a distinct improvement, that is, the lowering of the furnace into a pit. There is one run of pipe from the furnace as long as 16 feet and that pipe is nearly always dead. By putting the heater down 20 inches the effect was marked in the increase of circulation, and I consumed 4 tons less out of 16 tons I had been using.

In many city houses attempts are made to economize by covering the pipes with asbestos. I, with others, thought that would be a good thing, and the result was I got a cold cellar. In making the change of the furnace I ran the smoke pipe along the wall, and that served to heat the cellar.

MR. LYMAN—Mr. Snow speaks about the diameter of the firebox. It seems to me if the diameter of the firebox at the upper line is given, as is customary with manufacturers, we should have data relative to the diameter of the grate and the various local parts.

MR. SNOW—In a brick-lined furnace, of course, the pot is cylindrical, and in that case the grate area is taken as the average cross-section area of the firepot, whether at the top or at the bottom.

MR. BERRY—I find, in some cases, that the cold-air supply can be too large. Another thing is the way that cold-air supply is fed into the heater. Years ago, when heaters were put in under the direction of the men who made them, they put in what we call plates for throwing the air against the fire cylinder. If the supply is taken from the outside, where sometimes you have a wind velocity approaching what a fan would give, the heater pipes on one side won't get any warm air. On several occasions I have had to put in a series of ducts of terra cotta or sheet iron pipe and turn them up around the heater so that they would take the same pressure around the body of the heater.

PRESIDENT KENT—The condition exists in some houses that there is no arrangement made for the air to get out of the rooms, but yet the house gets heated. These rooms have double windows and are air-tight, but the rooms get heated notwithstanding it is against the laws of nature to say air can get in when there is no place to get out. Now, it must find some place to get out, but of course the circulation is imperfect.

I had a case years ago where it was impossible to heat the rooms in the front of the house with the wind in a certain direction. One day I took a kerosene lamp and warmed the pipe, and after it was warmed it started the circulation.

In some houses there are fireplaces in one or two of the rooms which are carefully plugged up to prevent the air from getting out. When this is done there are no outlets provided, so heating houses by hot air has scarcely reached a thoroughly scientific stage—one which provides, first, an air inlet; second, a circulating device, and third, an air outlet.

There is another point. In a house in which a circulating pipe is a long distance from the inlet pipe, when working properly, there is a strong downward current. When I inserted a piece of paper in such a pipe it was pulled down strongly and then shot up by air from the outside

which reversed the current and forced cold air into the chamber. These circulating flues, therefore, sometimes work backward.

MR. LYMAN—Referring to the large cellar mains, the average cellar we find up through the state does not have an elevation of more than 6 feet. It is rarely you find a cellar higher than that. The average heater has a 24-inch firepot, and when you come to put on top of that 10 more inches, in addition to the base, you get pretty close to the joist.

In regard to the method of circulating air back to the heater, one method is to take a return flue from each room and also have a cold-air supply taken through a terra cotta flue under the center of the furnace. You thus have a supply of sufficient fresh air with a positive circulation and there is no danger of short-circuiting the cold air back through the pipe.

(*Mr. Lyman drew a plan of such a system, which is presented herewith.*)

The only point in relation to this is that the heat risers to the rooms are larger than the circulating pipe, the relative proportions being 10 inches for the supply pipe and 8 inches for the return. The air that comes from out of doors would be regulated by the size of the house. With this system there is plenty of air for ventilating purposes, and at the same time a positive circulation in any room.

MR. CHEW—The good old custom of the times when I first became connected with the furnace business was to use the mason-work flue that had been abandoned for a smoke flue, often 9x13 inches and seldom less than 8x8 inches. I am firmly of the opinion that the 8x8 smoke flue effected better heating than the 4x16-inch, having practically the same area. In my opinion there is no flue that will approach a round flue. It carries a volume of air with little friction.

PROFESSOR CARPENTER—There seems to be no objection to the soundness of the position regarding round or square flues. One reason we do not get velocity through the chimney is because of friction, which is proportional to the area.

Take a flue 8x8 inches and we have 64 square inches and 32 inches around it. Another flue 4x16 inches, also containing 64 square inches, has more rubbing surface and more friction. The effect of this excess friction on the flow is very serious and so serious I think the engineers should always take it into account when designing flues where it is essential that they should give good flue area.

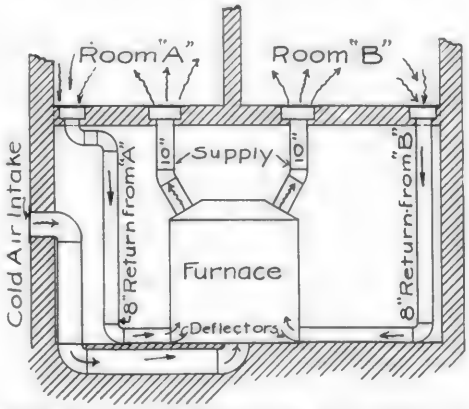
In the case of furnace heating, it seems to me to be one similar to all hydraulic problems. I think it is a problem that will be worked out on a similar line, when we will get a scientific coefficient or scientific design for air pipes.

MR. SABINE—In reference to the round-riser system, we have made a special effort in the last year to induce Philadelphia builders to use round risers. What induced us to do it more especially than anything else was that, in a majority of cases, the houses as built in Philadelphia have a chimney breast in the center of the parlor, which extends out about 12 inches. We never had difficulty to heat the parlor or second-floor room above the parlor, where we could use the round pipe. Of course, we also have tried to get people to put in floor registers for return cold air.

MR. DAVIS—Very often there are sliding doors and plenty of room for the round pipe. We have put in a great many furnaces in our section of the country, in Kansas City, with the round pipe. We have a great many installations out there where we return the air from all the first-floor rooms back to the furnace. We are great believers, in that country, of bringing all the air under the bottom of the ash-pit.

Also, in connection with the cold-air supply, we put in a swinging damper which closes off the supply of air to the furnace automatically, in a heavy wind. The wind blows against the damper and, by closing the opening, reduces the size of the intake. We have found it successful.

(*Mr. Davis made a drawing of this type of damper, which is illustrated on page 19.*




**METHOD OF CIRCULATING AIR BACK TO FURNACE FROM ROOMS**

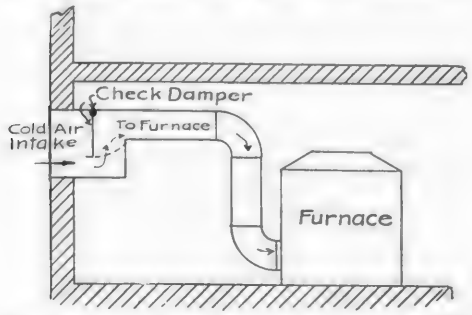
PRESIDENT KENT—What is this damper made of?

MR. DAVIS—Sheet iron or wood.

Another scheme we have is to provide a large ventilating flue running from the attic and of sufficient capacity to carry the necessary ventilation required for the house. In that we place a damper, and if we want to lessen the air supply we close the damper. If we want to ventilate the building we open the damper. All the rooms in the house are connected with this one flue. Answering a remark that the best results in ventilation were secured by the use of fresh air chambers, Mr. Davis said:

If we could go to the expense of building large fresh-air rooms, I think that, by all means, they would be the best. This is a cheap scheme of something that anyone can put in.

MR. BERRY—Mr. Snow, in his answers, refers to the temperatures at the registers. I would like to know if there is some standard way of taking the temperature back in the pipe, or a foot away. I have personally made a great many tests and have used thermometers




TYPE OF COLD AIR BOX EQUIPPED WITH AUTOMATIC CHECK DAMPER

encased in armor, such as the beef packers use for testing beef, pushed back in the register 4 or 5 inches, and I find that almost always the temperature in the registers taken back 4 inches is higher than the temperatures Mr. Snow has given.

### Topic No. 1

*The Increased Tax on Indirect Heating Apparatus, Due to the Use of Partition Flues, Owing to Their Shape and Restricted Area.*

This topic was covered by the foregoing discussion.

### Topic No. 2

*The Difference Between the Theoretical Estimate and the Actual Consumption of Fuel Required for Heating Buildings.*

PROFESSOR CARPENTER—At one time we made a test in a large building and compared the actual heat wasted with the actual fuel consumed. Knowing the actual amount of steam produced, our theoretical and actual results came out very closely. If the topic means how the theoretical results checked up with practical methods, I should say they checked up very nicely.

PRESIDENT KENT—There are six different losses of heat we have to consider—

1. Heat conducted through the walls.
2. Heat required for ventilation.
3. Heating air in excess of that required.
4. Heat lost due to imperfect combustion.
5. Heat required to furnish chimney draft.
6. Heat for heating air in excess of 5.

PROF. R. C. CARPENTER—We noted the amount of heat carried off by air, and by obtaining the dimensions of the building, we checked up by the coefficient rule given in my work on heating and ventilation. The results checked up closely, the trial lasting over seven weeks.

PRESIDENT KENT—We have guarantees to heat buildings to 70 degrees, but I have not heard of a guaranty to heat a building with a certain amount of fuel. I have an impression that heat loss number 6, which I have just mentioned, is rather a small one, especially when using anthracite coal. In 1, 2, 3, and 4 there are great losses, due to excess ventilation, and great losses due to imperfect walls, single windows, etc.

MR. DAVIS—In a furnace in my own house I burned 17 tons of coal one season, then spent my vacation in remodeling the apparatus, and the next year burned 8 tons of coal. I lowered the furnace 18 inches, increased the air supply 75% of the capacity of the pipes, and put in return-air connections from the large room on the first floor and one on the second floor. It reduced the fuel bill more than one-half.

### Topic

*What Is the Amount of Water Evaporated by One Pound of Fuel in Actual Furnace Experience?*

PROF. CARPENTER—I have made tests of hot water heaters. I have tried to operate them, at least approximately, in the way they would be operated in use—that is, by making tests at frequent intervals, putting on coal once in four hours, and trying to run the heater up to about four pounds of coal to a square foot of grate per hour. At other times I have tried to keep a thin fire, supplying the coal at intervals and feeding slowly so as to burn four pounds per hour.

Under these conditions I have found in three cases that the economical results were good.

It is my impression that the house-heating boiler does about as well as the large power boiler, and you can expect a return in steam somewhere near 70% to 75% of the coal—anthracite coal.

DR. KITCHEN—All the manufacturers claim an efficiency of nine pounds of water to one pound of coal. As I have gone over the data, that is about as good a showing as is made in most high-power boiler tests.

PROFESSOR CARPENTER—In three of my tests I did the firing myself. I may not be a very good fireman, but there was no attempt to fire in any but the ordinary way.

In two cases I ran the boiler one day, coaling at frequent intervals, four pounds of coal to a square foot of grate per hour. That is about what the house boiler is called upon to burn. I followed that test the next day, and in each of these cases I

ran ten-hour shifts, putting in two fires, one at the beginning and one at the middle of the day, with no particular difference in results. The efficiencies were fully as high as nine pounds. I concluded from these tests that the small house-heating boiler is as economical as a big one.

DR. KITCHEN—I have found the evaporation efficiency was four times as much running at a strong rate as at a slow rate.

PRESIDENT KENT—What was the best rate of evaporation?

DR. KITCHEN—I didn't run my boiler at a very high rate. About 6½ pounds of water was what I obtained.

PRESIDENT KENT—With a high rate of combustion you would get more?

DR. KITCHEN—I should think so.

## THIRD DAY, JANUARY 18—MORNING SESSION

### Power Required to Thread, Twist and Split Wrought Iron and Mild Steel Pipe

(This paper, by T. N. Thomson, was published in our January issue.)

DISCUSSION

MR. THOMSON—In preparing this paper I have used the word "power." Probably the word "force" would be more appropriate, according to the latest acceptance of the meaning of these words. But I think the word "power" is understood by all.

PRESIDENT KENT—I think we should congratulate ourselves on having such a splendid paper, giving so many facts.

SECRETARY MACKAY—I have listened to the paper with a good deal of interest, because in my earlier experience the first thing they put me to was cutting pipe, and in the day time we had to cut it with a screw machine that was run by power; at night I had to be the donkey power.

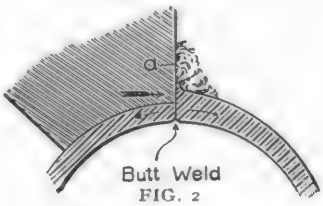


FIG. 2

they were never uniformly tempered afterward. It was almost a waste of time and money.

It seems that there has not been any improvement in the manufacture of dies for cutting pipe from that time, thirty-five years back.

There was a patented die on the market that had some points of advantage over the straight cut, plowing, cold chisel or planer movement (shown in Fig. 2) or in the worse condition, shown in Fig. 3, and perhaps in a little better condition in the last *b* of Fig. 3. But all of them come against the weld of the pipe, as Mr. Thomson has shown. The weakness is in the weld, and if that cannot be eliminated in the construction of the pipe, then there is an opportunity to improve on the cutting tools so they will not split the pipe at its weakest point.

The trouble is seldom in handling and placing, though it is sometimes due to imperfect weld at the mill; but I have seen more pipe split by cutting and threading it with imperfect tools and by placing it at too great a distance from the holding point at the vise. In the illustration of this (Fig. 5), while it looks fairly close, it is further away from the holding point than I would care to have it done. And when we look at the other illustrations (Figs. 6 and 10) there is a distance of 15 to 18 inches from the vise to the die. If you use a poor die that is going to strain the weld, and then hold it so far away, it is bound to split the pipe.

It seems to me that what we need is, first, better cutting tools for cutting off

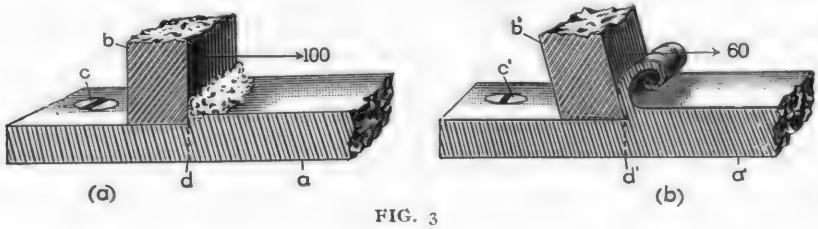


FIG. 3

At that time we used wrought-iron pipe. I do not think steel pipe was known. We had a good deal of trouble with the dies. The dies were something after the type of those shown in Fig. 2 (straight face). They were solid dies and more often split the pipe in reversing and backing out than in cutting the thread. To prevent this we used to have the dies recut, but found

and threading; and, second, greater uniformity of pipe. If possible, there should be greater strength of weld, whether iron or steel, butt or lap-weld.

The particular type of die to which I just had reference cut on an acute angle, with never more than one tooth in the weld at one time. The first tooth had passed the weld before the second was reached,

etc. The average workman who understood his business and knew what would split the pipe and what would not, obtained good results.

MR. H. H. WALKER—This matter of dies has been of very great importance in our factory (Curtis & Curtis Company). We have kept at it for twenty-five years to see if we could produce something that would handle all classes of pipe. The great trouble with us has been that the pipe, as it appears to us, in coming from the roller, is very apt to strike moist ground, or a water puddle, which leaves a scale on the surface of the pipe, and when it comes in contact with the die it is so hard it chips and breaks away the die.

I have listened with a great deal of interest to Mr. Thomson's opinion as to the grade necessary in the cutting, and the position of the die as shown in Fig. 4 is the one that corresponds almost exactly to the way we are making our die to-day.

PRESIDENT KENT—Is there any difference in the die's work on wrought-iron and on steel?

MR. WALKER—The wrought-iron is very much easier to cut and the scaling is not so severe.

PRESIDENT KENT—You don't find any wear from the die in cutting wrought-iron?

MR. WALKER—No, sir; no perceptible wear.

MR. A. F. HOWE—I would say that all our tools (Borden Company) are made with perhaps more than the 20% angle proper steel. I have run pipe machines and we did not have any more trouble thirty-five years ago than we have to-day We used nothing then but the solid die.

MR. WALKER—I think Mr. Howe will agree with me that in the pipe machine manufacture of to-day it is not the

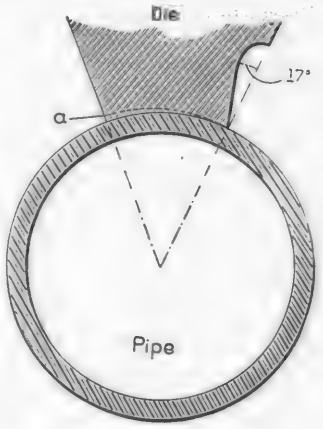



FIG. 4

fault of the die, but the fault of the man into whose hands the machine is placed. The machines are made to operate in a perfect manner. The average man who gets hold of a machine does not give it any attention. He cuts the pipe and when the whistle blows he drops his wrench or whatever he may have and scoots out of the building.

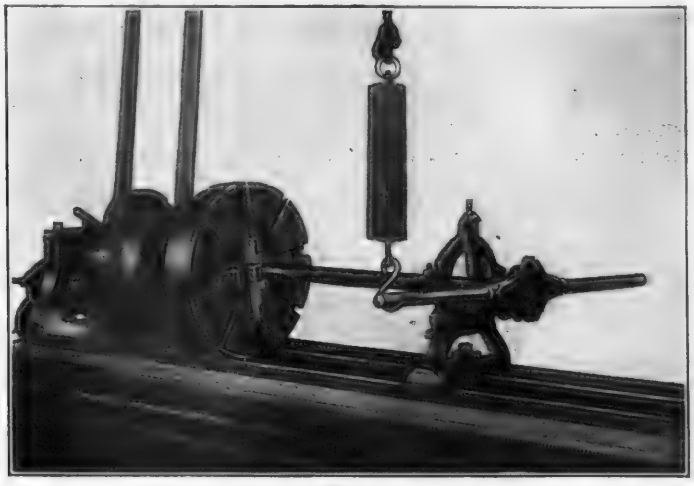


FIG. 5

Mr. Thomson speaks of. I was interested in what the secretary said about having but one tooth at a time on the weld. We have got over that, though we may have other troubles.

MR. BARRON—The form of the die is not everything. An important point is the steel of the die, and the great trouble with die-makers is to get them to use

Possibly he goes onto some other class of work in the afternoon. Another man comes along, uses the machine with the chips still in it, and he, too, neglects to clean it. Nobody is responsible for the care of the tool. The master mechanic and master steam-fitter should insist that the men keep the tools clean, as we do in the factory.

A pipe-threading machine must be kept clean, and if kept in proper shape there is no reason why it won't work perfectly. We have troubles, of course, but every time I have gone to see why a machine was out of order, invariably it has been because the machine was so stuck up with chips and oil that it was impossible to operate it.

So far as I know, we have never had any trouble regarding splitting pipe with our machines, and I think we have kept pace with the pipe-makers.

MR. GORMLY—I think this is one of the best papers ever presented. It comes right down to the facts. In our shop we have found trouble with dies. We have had pipe that cut like glass. Pipe we buy for iron is steel, and some we buy for steel is iron. We have had pipe that had no hole through it, and we have found a diaphragm in a pipe, as though a slab of steel or iron had peeled off and welded crosswise of the hole.We have had dies which were perfectly new, and after cutting one thread with them they would be as flat as the end of a lead pencil—absolutely not tempered or imperfectly tempered.

While there is much to be said against the material we get in the pipe and the material in the dies and the form of die, there is still something to be said against the ignorant handling of them. But we have found pipe, after we had it in, would snap off and the material in it would show crystals, as though tempered; it would snap off like glass. That kind of thing is unsafe, and I really think there should be municipal control of this matter; some kind of test in the various cities as to what grade of pipe will be tolerated at all. This paper brings out clearly the advantage of working in harmony, and shows us what associated action can do in the direction of improving pipe and die.

We have dies we are using now and one man will cut a 4-inch pipe end with greater ease than he could cut a ¾-inch pipe two years ago.

MR. DONNELLY—In connection with mechanics' use of dies, it has been a question as to which is the best way to catch a solid die, and one answer was to file a flat place at the top and one at the bottom of the pipe. Another was to oil the end of the pipe. I have known a man who was trying to catch a solid die to throw sand into it. I remember a man I worked with, whose practice was to file the top and bottom, wipe it off with waste, and then take a piece of chalk and chalk the pipe carefully all round. If he could not catch it then he would pour more oil on, wipe it off again and use more chalk. He couldn't catch it one day, and gave it up. He said it was a very bad die and he must get a new one.

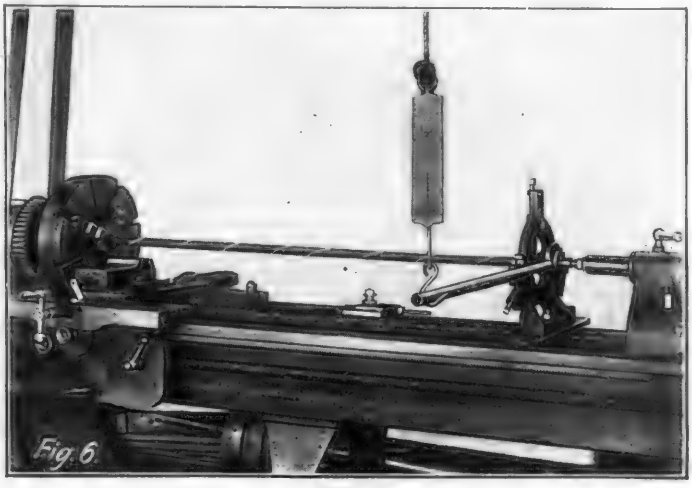



FIG. 6

When he was off taking a rest I oiled up the pipe and caught the die. I had always oiled the end of the pipe on the supposition that if the die did start to chip, the chip was not as liable to break off as if the pipe had sand or chalk on it.

Workmen will have their notions. One favorite trick is, if a die pulls too hard, to take it out and break the teeth.

MR. QUAY—The great difficulty we found, after steel pipe came into use, was that frequently the steel was harder on one side than on the other. We sometimes found it to be thinner on one side than on the other. The main difficulty in cutting steel pipe were these conditions I have just mentioned, and very often we would have to send the pipe back. We found after trying a few pieces that it did not pay to use them, it was not safe, so that on jobs where we could order our

pipe in advance, and could buy wrought-iron pipe from the mill direct, where we knew they made wrought-iron pipe only, we found it paid to do so, if we paid more for the pipe. We saved more time in the cutting than the difference in cost between wrought-iron and steel pipe.

We found, in addition, that the expense of keeping up the tools to cut this kind of steel pipe was something enormous.

While the question of the die seems to be an excuse for a poor quality of pipe, I disagree with the speakers who have said that there is no improvement in dies, for I know there is.

PRESIDENT KENT — Mr. Speller, how is it that sometimes there are hard spots in pipe and sometimes one side is harder than the other?

MR. F. N. SPELLER (National Tube Company)—There is usually something to be gained by engineers connected with the manufacturers' and consumers' interests taking up together such a subject as Mr. Thomson has so ably put before this society to-day. For that reason I appreciate your courtesy in extending the privileges of the floor on this occasion. We are always glad to welcome such a thorough and painstaking investigation as Mr. Thomson has made of modern pipe material.

Of course, the process of making pipe steel did not reach the satisfactory state of to-day at once. It is now twenty years since the first steel pipe was made, and in that period much experimenting had to be done. By making this special soft steel with the lightest degree of weldability in view and adapting every detail to this end from the ore to the finished pipe or tube, the result is a much more pliable and uniform pipe, better adapted to the numerous uses to which pipe is now put, and with the additional advantage of cheapness compared with wrought-iron.

The tests suggested and worked out by Mr. Thomson bring out the greater strength of the welded steel seam better than any experiments yet made, but such a test would be difficult to apply, as he suggests, in the mill. We find it pays to be strict with the testing and take every precaution so that all pipe is tested to 600 pounds per square inch, and some much higher when specified.

As manufacturers of our own dies and users of the same, we can corroborate Mr. Thomson's conclusions that it is just as easy to thread steel as iron when the die teeth are given a proper rake and are slightly relieved. This also gives longer life to the die and produces a cleaner cut thread.

The making of threaded joints is probably the most important detail in pipe work and one in which considerable economy can be made when all dies are made with due regard to these principles. The only explanation I can offer to the question you ask, Mr. Chairman, as to how "steel pipe" could be hard on one side, or surface hard, as described by a gentleman this morning, is that the pipe in question was cheap iron pipe composed largely of odd steel scrap which may be hardened by water cooling.

Our pipe steel resembles iron in that it is unaffected by quick cooling; this, and its high welding qualities and ductibility, puts it in a class by itself. To meet competition iron has undoubtedly been made by some of steel scrap, and such material has given much trouble with the dies and in splitting, which has been, to my personal knowledge, in many cases, credited to steel. Such experiences can be minimized, if not entirely eliminated, by using genuine soft steel pipe and paying due attention to the shape of the dies.

## Sizes of Return Pipes in Steam Heating Apparatus

(This paper, by James A. Donnelly, was published in our January issue.)

DISCUSSION

MR. QUAY—In reference to the size of the return pipes, especially the risers, for a 3-inch steam riser, there is used a 2½-inch return pipe, and for a 2½-inch riser there is a 2-inch return pipe. Can anyone give me the difference between the amount of steam and the return, how much will be reduced in quantity and go back in the return as water? I am talking about the gravity return system.

Answering another inquiry regarding the meaning of the term "static elevation," Mr. Donnelly said:

I used that term because the diagrams in the text books usually give the elevation. The steam main must be 28 inches above the water line of the boiler, and that I call static elevation.

PRESIDENT KENT—That means the steam main is high enough so that water will not back up into it.

MR. DONNELLY—That the weight of this column of water will be equal to the loss of pressure due to friction in the steam main.

MR. BARRON—This question of the size of the return pipe was taken up some years ago in one of our meetings. The problem was considered this way. A cubic inch of water evaporated into steam gives a cubic foot of steam and, logically, for that reason, making the return risers one size smaller than the supply riser was ridiculous. I have always advocated smaller return pipes. All return risers in all return systems are too large. Hopkins. I believe, said the return pipes would fill up with sediment and we should therefore make the pipes large for that reason, that the sediment deposited in the boiler was not blown out and would, in time, fill the return pipes.

MR. HARDING—Mr. Donnelly says

the size of the return pipe is governed, not only by the fact that you have to return water, steam and air to the boiler, but you have to return the pressure back to the boiler. If you reduce the return pipe, you have a much reduced steam main and consequent difficulty throughout the system. In other words, you don't get pressure back to the boiler.

PRESIDENT KENT—Do you recommend for use this table you have compiled of sizes for steam mains and returns?

MR. DONNELLY—Yes, sir.

MR. QUAY—The only answer to my question seems to be that, in order to get pressure back to the boiler, the returns should be large. I don't think that answers the question satisfactorily. I would not advocate using a ½-inch return pipe on a gravity system. I spoke of a 3-inch steam riser and a 2½-inch return, and a 2½-inch riser and a 2-inch return. The idea of using these large return risers in order to establish pressure on a boiler is too ridiculous to talk about. We find, in nearly all cases, that these are wet returns. As far as economy is concerned in heating a building, the principle is to condense the steam in the radiator and not to have the steam traveling through the radiator and through the return continuously, but condense it at that point and have the return large enough to carry off the condensation. There is no need of using a 2-inch return riser for a 2½-inch steam riser. You cannot figure it out from any scientific principle why you should have return risers one size smaller.

MR. GORMLY—We do make mistakes and it is a wise thing to make them on the right side. I haven't noticed whether this paper treats of friction on horizontal runs on return mains. I think that is an important thing to be considered, because very much depends on the grade of the main and the distance it is run horizontally. As regards the reason why a small main would not work as well as a large one, I think one reason is that the return water has a tendency to form globules on the return main.

SECRETARY MACKAY—I knew of a case, some ten or twelve years ago, where a prominent contractor had installed an apparatus. There was a 4-inch main, running from two boilers, 100 feet either way, and he had carried a 2-inch dry return back in under the steam main and then dropped it down to the boiler. He was troubled with water rising and filling up the end riser. He then enlarged the returns. I gave an opinion that if the return was enlarged to 3-inch it would overcome the entire trouble. It was done in that building and also in another building where the return was 1½-inch. In both cases, instead of the boiler being at fault, as claimed, the trouble was altogether in the small size of the return main as proportioned to the steam main.

I have had trouble with gravity apparatus. I have a case in mind now where an engineer laid out certain size steam mains and certain size return mains, which were sent to a contracting engineer who submitted them to a consulting engineer. He claimed that there was 3 feet difference between the water line of his boiler and the extreme end of the main. I had a water gauge put on and I found that there was 16 inches with no fire in the boiler and no steam on, between the bottom of the extreme end of the main and the water line of the boiler. As they increased the pressure in the boiler you could see the water go up the three-foot gauge until two-thirds of the steam main would be submerged. This was due, first, to too small a steam main and, second, to too small a return main. I believe, in that particular case, had the return main been the same size as the steam main, it would have removed all trouble.

Mistakes are often made in the sizes of return risers in this way. I have found good mechanics unable to distinguish between the vacuum system of return and the gravity system. I have gone over work with a member of this society whose engineers did not discern the difference between one and the other. The result was, he had trouble on half a dozen of his gravity systems and when he enlarged his returns, it overcame the trouble.

MR. QUAY—I agree with Mr. Mackay about return mains. That is a different proposition. It is only the return riser, the proportion between the steam riser and the return riser that I am talking about.

MR. BARRON—Three years ago I put up a little job, a four-story building with a 2½-inch steam main. I presume there was about 1,000 feet of radiation and I used an ordinary type of boiler. The point between the water line of the boiler and the lowest point of the steam main was about two feet. The largest return was 1 inch. I wanted to experiment with it and prove to my own satisfaction that I would not have any trouble with a 1-inch pipe, dry and wet return, and all above the floor easy of access. The returns were not sealed. The apparatus worked all right except that at that point, where we got between the steam main and the water line of the boiler, on one cold day we had trouble with the water backing up and sealing that riser with water. Two feet did not give us a static head, as I understand it.

PRESIDENT KENT—In the paper it is not clear whether return risers or mains are indicated.

MR. DONNELLY—It applies to both.

MR. WOLFE—There is one little point made by Mr. Quay that I object to, and that is the condensation of steam at

the radiator. Some of the steam is carried back to the boiler.

MR. B. H. CARPENTER—I did not understand how Mr. Mackay's idea of enlarging the steam pipes worked out.

SECRETARY MACKAY—The return

RETURN, SHOWING WATER GAUGE TO DETERMINE HEIGHT OF WATER UNDER PRESSURE

served, not only as a waste pipe, but for equalizing the pressure, so that there was a uniform pressure in the steam and return mains.

MR. B. H. CARPENTER—Will not that work in the steam line on the same proportion?

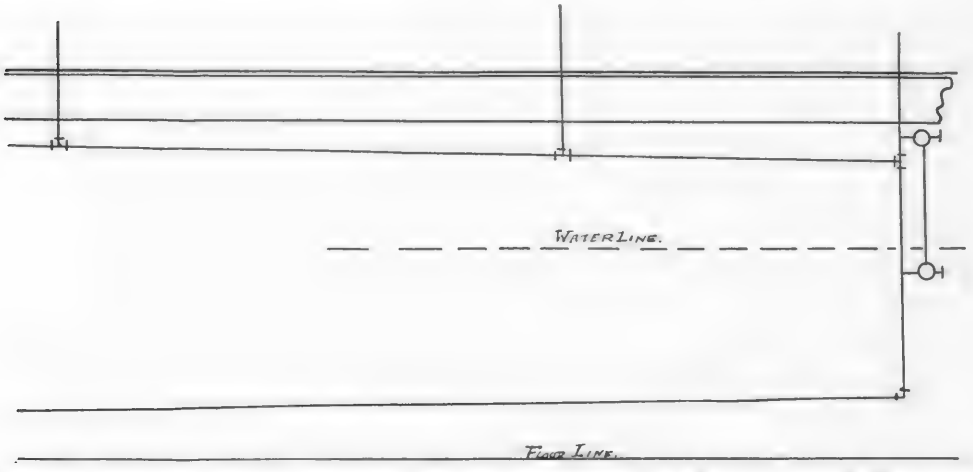
SECRETARY MACKAY—The steam main was there, giving an ample supply for the radiation, but the return line would not take back the condensation and equalize the pressure at the extreme end of the steam main. As a result, the steam main was completely flooded, as shown by the gauge.

(*Mr. Mackay drew illustrations of his arrangement of the apparatus, which are reproduced herewith.*)

Here you have your steam main and your riser and drip pipe. The steam main was completely submerged. By equalizing the pressure, you keep the water at the proper level, not only in the boiler, but in the entire system.

MR. QUAY—I said steam condensed in the radiator. Of course, that is a general term. We know it is not all condensed in the radiator. It has to pass through the return, unless you have an absolutely accurate valve of some kind that won't let steam pass through. I don't mean absolutely all, but there is no necessity for making the return riser large enough to carry a large bulk of steam.

SECRETARY MACKAY—(Referring to his illustration) I have indicated the water line of the system when standing




RETURN, SHOWING WATER GAUGE TO DETERMINE HEIGHT OF WATER UNDER PRESSURE

cold. The extreme end is near the water line. The pressure was raised and the water gradually crawled up the gauge. The pressure of the steam forced this water up into the radiator.

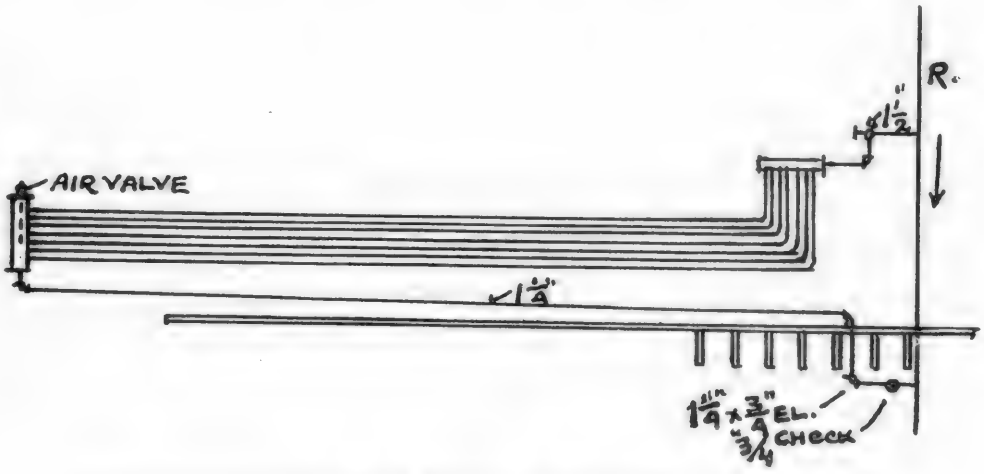
MR. CARPENTER—Any connection on the return pipe near the boiler?

SECRETARY MACKAY—Only the usual drips.

MR. CARPENTER—It is possible these drips were flowing into the return pipe and equalizing the pressure in that way. By putting a larger return, you allowed the steam to go through the drip into the return?

SECRETARY MACKAY—There was a trap. In another case, I put a gauge on a wet return and as the pressure rose, the gauge showed a rise of the water.

*(Mr. Mackay illustrated this arrangement, which is reproduced herewith.)*




STEAM COIL, SHOWING USE OF SMALLER CHECK VALVE ON RETURN

MR. SNOW—About the only case I know of, where the steam main is larger than the return, is in our basement, where we have unusual conditions. We have pressure on the steam main, but additional water has to be accumulated to overcome the friction in the returns. Therefore, by keeping the mains large, we avoid or reduce, as far as possible, the tendency of flooding the radiators or steam mains, as the case may be. Where we are returning into an open tank, we expect to have a pressure of, say one pound of steam, at the end of the system. So we start with a differential of one pound of pressure. With that arrangement, we have little backing up of water, the difference in the pressure of the two ends overcoming the pressure in the return. In such cases, you can make the returns smaller.

MR. DONNELLY—In Atlantic City there was a man who said he could carry mains 250 or 300 feet and there would be exactly the same pressure 200 feet away as in the boiler. Everybody tried to convince him that there would be a decrease due to friction.

The larger the steam capacity, the larger the return main. Figuring the return main by the rules given here, practically 23,000 feet for a 10-inch main gives a 6-inch return main. You cannot get 23 square inches of area in a 5-inch main. It would be 78 per cent. of 36. Close to 24 or 25, say a 6-inch return. I don't think Mr. Bolton designed his rule for large sizes.

I am making it a practice to specify somewhat larger returns, especially in factory buildings, where the size of the pipe does not matter as regards appearance. Then it is stronger, for people run over and against it. Mr. Gormly says a job is never spoiled by making the mains too large. That is true of steam mains but not of extra large sizes of dry returns. Dry return systems are sometimes made worse, rather than better, by large sizes.

To refer to Mr. Mackay's remarks, I believe in the case he cites, he had 2,000 or 2,500 feet of radiation on a 4-inch pipe. There was a heavy drop on the main, which is an abnormal condition and I think his remedy would be good in that case.

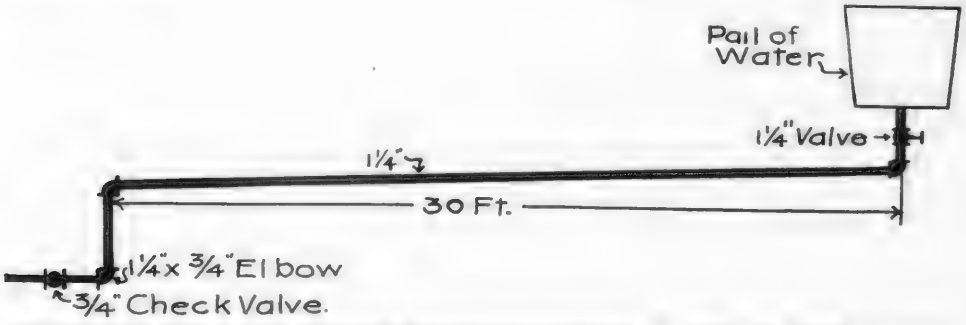
### Topic No. 3

*Is there any Advantage in Placing Check Valves on Return Connections of Steam Radiators, Discharging into a Single Down Pipe from an Overhead Steam Main, Returning to a Receiver, and if so, Can Check Valves Be Used of Smaller Size than the Return Connection?*

(A written discussion, by A. M. Feldman, was read by the secretary as follows:)

Last year I designed and installed in a factory, an overhead single pipe system with long coils and wall radiators. Each coil and radiator was provided with a top, steam and bottom return connection to the same riser. To simplify the shutting and opening of the coils and to facilitate circulation, I used a valve on the steam connection and a check valve on the return connection, but as some of the coils required 1½-inch and 2-inch return connections, it occurred to me that the checks would be too heavy to open and would require too much static head to clear the condensation. Besides, there would always remain some water in the return connection behind the checks. On account of its weight, the check would only lift slightly, the discharge would be sluggish and dirt and sediment would be bound to accumulate around the seat and, sooner or later, the check valve would become inoperative.

I reasoned out that if I should use, with the same or even smaller head over the check, a small check valve with a very light disk it would open fully and the water would pass the restricted opening with a higher velocity than in the pipe, thus preventing any possibility of dirt settling around or on the seat. I decided to make an experiment to confirm my reasoning.




METHOD OF TEST TO DETERMINE POSSIBLE REDUCTION IN SIZES OF CHECK VALVES

I rigged up two 30-foot lengths of 1¼-inch pipe with the usual pitch and a drop leg at the end of 12 inches. At the end of one leg, I placed a 1¼-inch check and, at the end of the other leg, I placed a ¾-inch check with the back of the disk filed down to make it very light. (See accompanying sketch.)

At the head of each pipe, I had a pail of water. I timed the discharge of an equal quantity of water through one check and then through the other and found that my surmises were correct; namely, that the disk on the 1¼-inch check was so heavy that under the full head of water, it could not lift up fully. With the diminution of the head, the discharge became less and less and more sluggish. It finally closed, retaining in the pipe over one-quarter of the original quantity of water in the pail. With the ¾-inch check, the water discharged in a full stream, the check opened fully and almost all of the water was discharged, there remaining only a couple of inches in the vertical leg over the check. The time of discharge was also less with the ¾-inch check than with the 1¼-inch.

On the basis of this experiment, I installed ¾-inch check valves on an entire job requiring 1-inch, 1¼-inch, 1½-inch and 2-inch return connections. In each case, when possible, I carried the return connection under the coils above the floor and dropped under the floor near the riser, thus providing plenty of static head. I connected the ¾-inch check to a reducing elbow and a ¾-inch nipple to the riser. I specified the seats of the checks to be round instead of square and all of the disks filed down as much as possible to reduce their weight.

The system has been in operation two winters very successfully. The coils clear themselves of practically all the water and the checks do not stick. I now make this my practice in all overhead single pipe systems, where long coils or radiators are used.

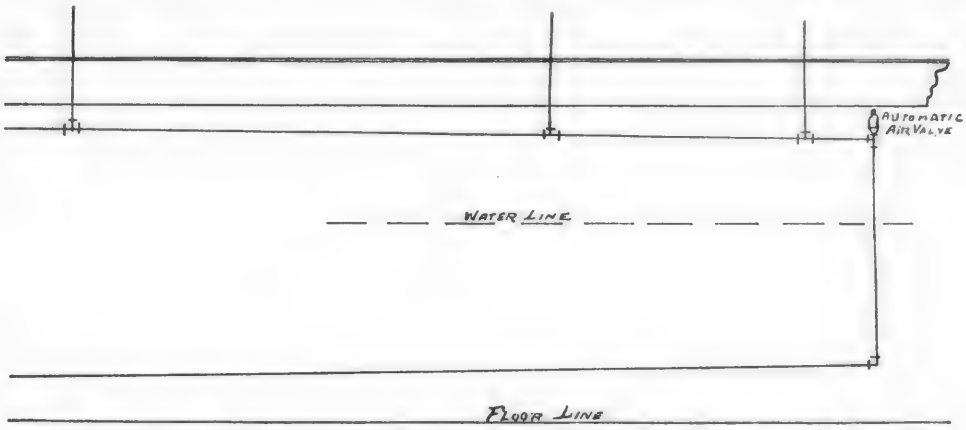
It should be noted, as I stated above, that I used two connections for each coil or a long radiator. Whenever I have to use a very large radiator, I install a hot water radiator so as to have the top connection for steam. I thus obtain perfect circulation. I have also, with apparently good results, used the same scheme of reducing the customary large check valves on coils for blower systems, by having a large return connection on each coil, but smaller check valves near the discharge into the return header.

**Topic No. 4**

*The Advantage of Automatically Venting the Extreme Ends of Steam Mains in the Basements on Low Pressure Gravity Steam Heating Apparatus and the Proper Mode of Connection.*

SECRETARY MACKAY—I suggested this topic because I have found trouble in low pressure gravity apparatus

through the improper venting of the steam main. I have in mind a case now, where I looked over a job twenty-five years ago, which W. H. Warner, one of the earlier steam men, placed in Albany,




METHOD OF VENTING STEAM MAINS AND PROPER LOCATION OF AIR VALVES

N. Y., a large gravity apparatus. His installation was according to the two-pipe method and there were no air valves on the radiators at all. All the dead air in the steam space of the boiler, in the steam mains in the basement, and in the radiators was dispelled from the system in the basement instead of in the room, through automatic air valves placed at the basement ceiling in the return lines.

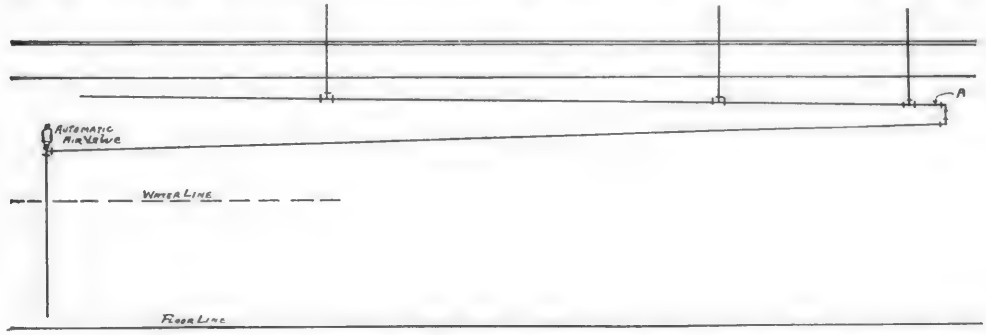
To-day we are using, largely, gravity systems, automatic air valves that close against heat and water. Following this old practice of Warner's, I have found it a good thing to take the air from the steam space in your boiler and discharge it in the cellar, instead of in the living room. Also I found it preserved the water line better than if you did not have it, because there are times when the radiators are shut off and as a result the water will rise into your main.

I had a recent case where a party told me he was having trouble. I asked if he vented the steam main and he said he did not. I suggested he put an air valve on top at the extreme end. When I saw him again, he told me he had done so, but that the system was not working any better. I asked where the valve was. He had placed it at (*A*) in Fig. 2 and the result was that it filled up with water.

*(Mr. Mackay's sketch is reproduced herewith.)*

I think that is a point that is often neglected in gravity apparatus. We depend on the air escaping from the radiators, instead of taking it out at the basement. The air valve will close against water by flotation and against heat by expansion.

MR. HARDING—I put up at a hotel in New England where they gave me a room at the further end of the building, a distance of 200 feet. I turned on the steam—I was the only guest in the hotel at the time—and it was a very long time before I got any heat. When I went to the table, I mentioned it. They put the




METHOD OF VENTING STEAM MAINS AND PROPER LOCATION OF AIR VALVES

I have found the best place for the air valve to be as shown in Fig. 1, at the top instead of at the side.

*(Mr. Mackay illustrated the arrangement, which is reproduced herewith.)*

air valve on the end of the steam main before it entered the return and now they can get steam in the radiators at that end of the building in about one-half the time that they did before.

## THIRD DAY, JANUARY 18, AFTERNOON SESSION

### A New Vapor Vacuum System of Steam Heating

By JAMES A. DONNELLY (Member of Society)

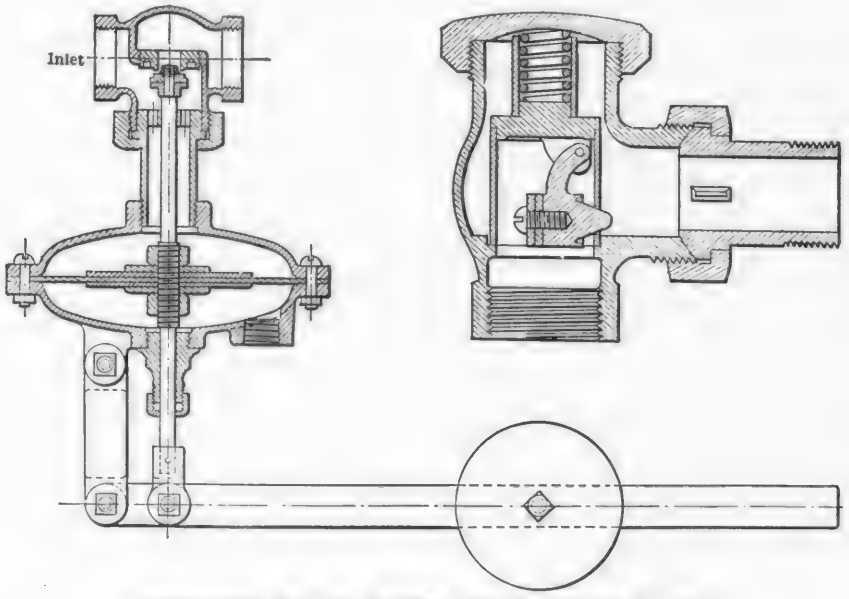
The system described in the following paper and illustrated in the accompanying cuts was designed to work under the same principles as those governing mechanical circulations, where a vacuum pump is usually used upon the main return.

It was believed that if correct mechanical devices were employed a gravity return system could be made to work in a similar manner to a vacuum exhaust system and with all the advantages of the latter. Chief among these might be mentioned the doing away with the automatic air valve, that most irritating and annoying of all contrivances, which is supposed to be a necessary evil in connection with each radiator; the practicability of graduating the inlet valve to secure a partial heating of the radiator; also the advantages of running the entire system upon a vacuum or at as high a pressure as might be desired.

Referring to the cut, it will readily be seen that the system is piped exactly the same, and with the same size pipes as any ordinary two pipe dry return gravity system. All moderate sized systems are piped in the manner shown, and where larger systems are installed the only change is to provide additional points of air removal and run a wet return system if desired.

The hot water type of radiator is usually employed and the steam inlet is made at the top. No air valve is placed upon the radiator, as the air and water are both carried through the automatic drainage valve and down to the cellar. The water is then allowed to run to the boiler by gravity and the air removed by an automatic relief valve, located at the boiler in ordinary installations or at the foot of the riser or group of risers in large systems. The drips are sealed from the return in the usual manner, either by a loop seal or check valve.

The construction of the automatic valves is shown in the small cuts, in which it will be seen that the discharge valves for the radiators are a special form of automatic impulse valve, in which the seat is made of considerably smaller area than the pipe connections. It is also at such an angle as to prevent wedging or sticking, and it will pass the ordinary dirt of the system without trouble. A cone projects from the disk of the valve into the opening of the seat and a counterweight is applied in such a manner that they both act to render the opening of the valve very gradual for increasing differences in pressure. On the disk of the valve there is placed an impact surface which is designed to materially increase the opening when water is passing.




AUTOMATIC RELIEF VALVE AND DRAINAGE VALVE

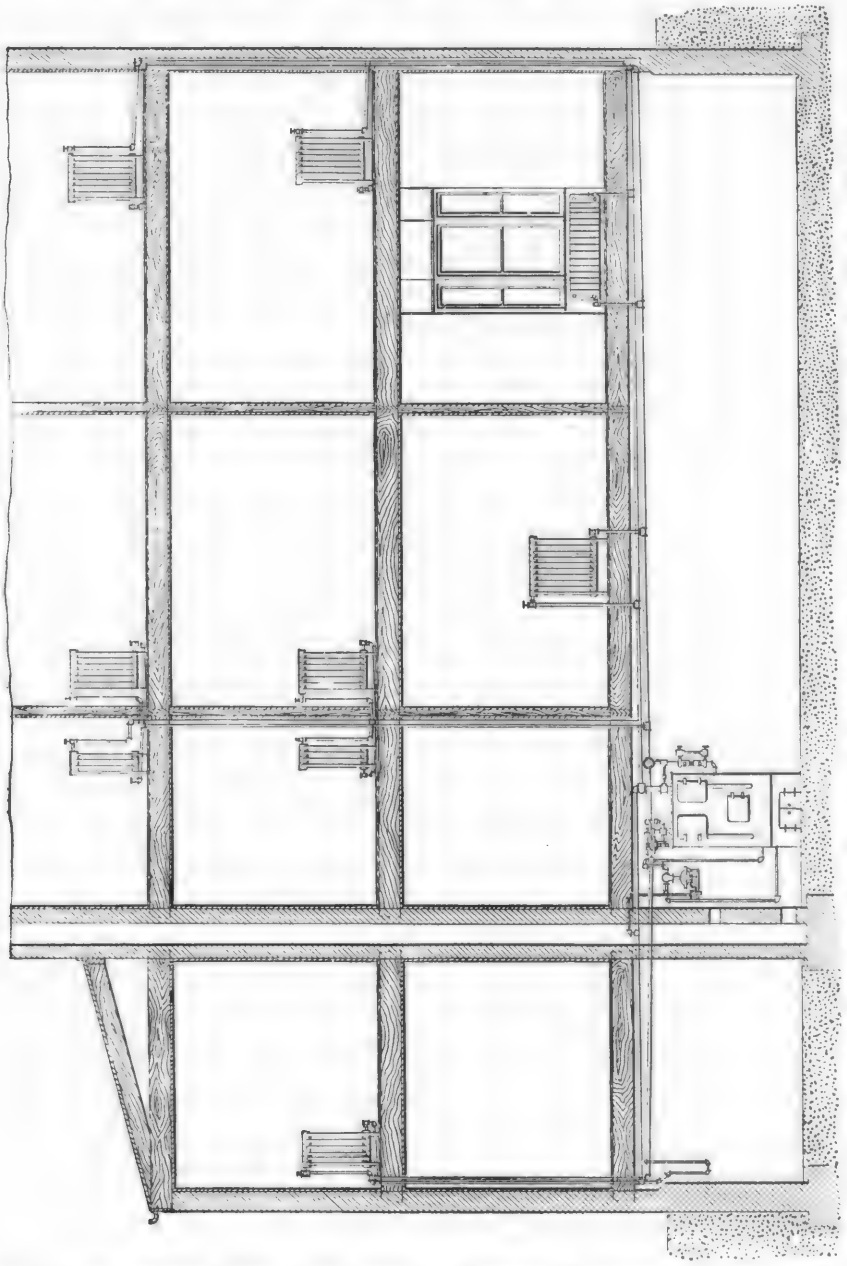
The removal of air from the return pipe is accomplished by means of the automatic relief valve, which is acted upon by the varying pressures created in the return pipe by reason of the presence of air or steam.

With the boiler filled to the proper water line and a fire started, the action of the apparatus is as follows: Steam is

generated and enters the main, and the friction of its flow causes a pressure in the boiler which communicates itself to the under side of the diaphragm of the relief valve and closes the air outlet. This outlet remains closed until the pressure passes into the radiators, opens the automatic discharge valves and compresses the air in the return pipes. The relief valve then opens and passes the air as fast as the combined delivery of the discharge valves. The flow continues until the air passes out of the radiators and return pipes, and the pressure in the returns is sufficiently reduced by the condensation of the steam to allow the relief valve to close.

As the automatic relief valve operates in the same manner as an air valve it is adjusted in the same manner; the weight is pushed out upon the lever until the valve is opened and blows steam freely; when the return pipe is free of air and thoroughly heated the weight is pushed back until the flow ceases.

A lower pressure than that in the steam main is then continually maintained in the return main, the difference depending upon how much difference in pressure is required to pass the amount



TWO-PIPE DRY RETURN GRAVITY APPARATUS EQUIPPED WITH VAPOR VACUUM SYSTEM

of steam that is condensed in the return pipes through the automatic valves upon the radiators.

If a radiator that has been shut off is turned on, the air passes into the return through the automatic valve at the same rate, or under the same difference in pressure, as the steam through the other automatic valves. The pressure in the return then rises and opens the relief valve for the expulsion of the air.

By reducing the weight upon the relief valve a little more than is necessary to close it and just leaving it heavy enough to open when the system is cooled down, it is very easy to keep the return pipes partially filled with air at all times. This air flows along with the steam and collects at the relief valve, ready to be discharged whenever some is introduced from a radiator.

Any radiator may be partially heated by graduating the opening of the inlet valve upon it. Steam then enters and passes across the top of the radiator and water collects in the bottom until the air in the radiator is compressed, both by being reduced to smaller volume and by heating, to equal the pressure in the return; the water then passes out and the radiator is not further heated until the volume of steam admitted is sufficient to cause the drainage valve to pass air as well as water.

The weight upon the automatic drainage valve is made of minimum amount, or just sufficient to close it, and it is thus opened by a very light pressure or head of water.

The system is run as a vacuum system by first raising enough pressure to expel all the air, and then allowing the fire to cool until the desired amount of vacuum is obtained; the entry of air from the discharge of the relief valve being prevented by a check valve or other similar means.

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Before Mr. Donnelly's paper was opened for discussion, Mayor Franklin P. Stoy, of Atlantic City, N. J., was given the privilege of the floor to invite the Society to hold its next mid-summer meeting in Atlantic City. Others who spoke in favor of Atlantic City, were Mr. Newlin Haines, of the St. Charles Hotel, of that place, and Secretary Henry B. Gombers, of the Master Fitters' Association. Mayor Stoy's invitation was courteously received by the Society, but the sentiment was all the other way, as was again shown when the meeting, before adjournment, definitely went on record as favoring the West.

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DISCUSSION OF MR. DONNELLY'S PAPER

PRESIDENT KENT—What is the purpose of that outlet from the diaphragm valve?

MR. DONNELLY—To discharge air.

PRESIDENT KENT—Air only or for water?

MR. DONNELLY—Not for water.

MR. JAMES MACKAY—Where is the air discharged, in the ash-pit?

MR. DONNELLY—It may be discharged in the ash-pit, into the chimney flue, or simply into the air.

MR. JAMES MACKAY—If the water should find its way through the automatic relief valve into the main or return, this controlling valve prevents water finding its way into the discharge?

MR. DONNELLY—Water can never rise into this, because it connects from the top of the return main.

MR. GORMLY—It seems to me there would be a tendency for the radiator to expand at the top, with the liability of rupturing the radiator at the bottom nipple.

MR. DONNELLY—There are a number of systems and methods of heating which use hot water radiators with steam connected in this manner. Probably some of those who have been using these radiators for a long time can tell us about it.

MR. GORMLY—In a case I had, in every instance, where we put in radiators, inside of three years we had to take them out. It cost us about twice what the job was worth in each instance. I have been shy of that system since, though I believe the trouble may have been caused, in that instance, by the manner of connecting the radiators.

MR. BARRON—I want Mr. Donnelly to tell us how his system is superior to systems illustrated in our proceedings some years ago, furnished by a Frenchman, Mr. Devoe, of Paris. They were gravity vacuum systems. A number of American vacuum systems are quite similar.

MR. DONNELLY—The French system, as I understand it, is a vapor system and not a vacuum system, though it might be made one. The principle superiority of this to that, I should say, is that these radiators are very close to the maximum temperature. They equal the temperature of the steam in the boiler probably more nearly than the French system. Another advantage of this system is that, if necessary, it can be run at any pressure. You can graduate the heat in any individual radiator, while running under pressure.

One other advantage, I think, is that there is no special attention or method necessary to condense the steam delivered into the return pipes, the return pipes themselves not being specially used for condensing purposes. The diaphragm has the pressure upon one side, within a quarter or half pound of the pressure on the other, and it is impossible to rupture the diaphragm. Having water on both sides, it does not become vulcanized or

get hard, as it would with water on one side and air on the other.

PRESIDENT KENT—No automatic air valve in the radiators?

MR. DONNELLY—No, not at all.

PRESIDENT KENT—Do not the radiators fill up in condensation?

MR. DONNELLY—No sir, perfectly clear.

MR. JAMES MACKAY—In graduating the radiation, one statement says this can be readily done by graduating the opening of the supply valve. How is it done—by hand?

MR. DONNELLY—Yes.

MR. JAMES MACKAY—Will this controlling valve, that controls the air outlet, close automatically or does it depend on some pressure to close it?

MR. DONNELLY—On excess pressure in the steam main over that in the return main. If there is 15 inches of vacuum in the steam main, there would be 15½ inches of vacuum in the return main.

PRESIDENT KENT—You say "riser or group of risers."

MR. DONNELLY—That would be on the return riser.

PRESIDENT KENT—What prevents the water coming out of that inlet?

MR. DONNELLY—It is far enough above the water line so that the water does not reach it.

MR. BARRON—I think this paper shows we are evolving an almost perfect system of house heating. We have overcome the defects of the French systems and others.

MR. DONNELLY—Referring to the steam main, sometimes it pitches back towards the boiler, so that there is no drip necessary at the end of the steam main. When the steam main pitches down from the boiler and a drip is necessary, it is dropped down sufficiently to seal the steam from entering.

PRESIDENT KENT—Does the water accumulate in these radiators?

MR. DONNELLY—The water does not accumulate at the bottom. Suppose you had a moderate pressure on the boiler of 2 or 3 pounds. When steam is turned on, the radiator is full of air at atmospheric pressure, and this air is compressed and heated by the entering steam until its pressure equals that of the return. The higher pressure you are carrying on the boiler, the higher that compression of air would be carried before the discharge valve would open. A small quantity of water would collect in the bottom before that pressure would rise high enough to open the valve.

PRESIDENT KENT—Suppose you shut off the steam on the radiator and the steam within becomes condensed. Would that make a vacuum in the radiator?

MR. DONNELLY—Yes; the same care must be taken to make the return valve tight. A leaky valve on the return is open to the same objection in this system as in the two-pipe gravity system—the water will collect. On the two-pipe system, the water will not run out when the pressure drops, but this automatic valve will open when the pressure drops, so that the water will run out of the radiator.

This impulse valve I use with a difference in pressure of ¼ to ½ pound. On radiators or coils containing as much as 400 or 500 square feet, I use impulse valves with a ¼-inch seat and run the radiators at less than ½ pound difference in pressure. Unless the amount of radiation on the return is very excessive, you need have a comparatively small amount of steam passing to the return main. These valves will pass steam in passing water, or water in passing steam, whichever way you figure it.

If the risers supply radiators of different sizes, one having very large radiators and the other small radiators, the difference between the two groups being considerable, each one should have separate control; but if the two risers are of the same class and only a moderate distance apart, they could be connected because the conditions in the two would be approximately the same.

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## Forced Draft for Boilers

By L. J. WING, (Member of the society)

L. J. WING

IN account of the great importance of the subject to all designers of power plants, and to heating and ventilating engineers particularly, I bring the subject up, and trust that those who have had experience in power plants, or who have studied the conditions of the subject, will give their opinions and results of their work.

Natural draft, sufficient to get even fair returns from the fuel consumed by the plant, means very tall and expensive chimneys, and if the business grows so

that more power is needed, the chimney cannot be enlarged and a new one must be built.

In looking into the matter carefully, it seems to me that natural draft for boilers is somewhat similar to natural draft for ventiation. When I went into the ventilation and heating business some twenty years ago, the practice, with few exceptions, was to build flues or ducts for creating drafts and to accelerate the draft, heat was applied by means of fire, steam coils, jets of gas, etc.

On making extensive tests, I soon proved that with a disk or centrifugal fan I could move many times as much air with steam, gas, or electricity for driving the fan as I could move by using the same amount of heat units, applied directly to accelerate draft in a flue or duct, in a given size. To-day the heated flue for ventilation is practically obsolete, and fans are used by the thousands, giving good, reliable, practical results.

In looking over the question of draft for boilers, the same conditions arise. The most of the boiler plants in this country are run by the natural draft of tall, unsightly chimneys. Is this not an expensive error? Cannot better and more economical results be had by the use of fans of proper construction and especially adapted for the work?

To-day there are three systems in use to some extent. One is by the steam jet blower system; one by the fan driven by engine or electric motor forcing air under the grate, and one by use of fans on the plan of induced draft.

Each one seems to have serious objections.

The steam jet blower takes too much steam and is not perfect in other respects.

The fan for forcing air under the grates takes up valuable room and is quite excessive in cost for installation and has other objections.

The fan for induced draft is still more costly and has serious objections.

I believe that if practical engineers give this subject more thought, and make some practical tests, that boiler plants can be made very much more efficient, and gain largely in capacity and economy.

Taking up the construction and application of fans as used for forced or induced draft, I do not find any material change or improvement for some years. I note, however, that the English are now using a good many fans of the type called Sirocco, which they claim are smaller, occupying less space, and giving better results than the regular centrifugal fan. Centrifugal fans driven by direct attached turbine engines, to be used either for forced or induced draft, have been used on account of the high speed at which a small fan can be run, and allowing the steam from the exhaust of the engine to go through a separate pipe under the grate, very much better results are secured as well as a large saving of fuel, and also a saving in the cost of construction.

Another fan and turbine engine combination of a still more compact and simpler construction is adapted for the centrifugal cone or disk types, so that it can be used for various purposes.

For forced draft, this fan is placed inside of a short drum, or pipe, that can be placed in the side or rear wall of the boiler and takes up space available for other purposes. This fan has a series of cups or buckets placed on it in a simple manner in such form that the fan and turbine engine are practically one complete machine, running on ball bearings, and driven by one or two small steam jets similar to the regular turbine steam engine or turbine water wheel.

The steam jets force the fan up to a high speed, moving a large volume of air and at the same time carrying along the steam with it, thus thoroughly mixing the air and steam and allowing it to go in under the grate dry and at a good heat.

Each boiler has its own fan. A pipe is carried from the fan to the top of the boiler, or any other place where hot air can be obtained, thus saving heat units and at the same time ventilating and cooling the place from which the air is taken.

Such a fan is inexpensive to install, takes little space, effects a saving in fuel, increases the capacity of the boiler, requires little steam to operate and utilizes this steam to aid combustion, avoiding clinkers, and reduces the repairs needed.

By having the damper partially closed, and controlled by a regulator that also controls the speed of the fan, an equal pressure of air is maintained beneath the grate and a plenum above which will give all parts of the tubes the full benefit of the combustion gases and hold the pressure of the boiler within one or two pounds of the pressure the regulator is set at.

If the foregoing are facts, a long stride in improved boiler draft has been accomplished, but there is still room for more improvements, for saving in cost of power plants, and economy in use.

DISCUSSION

MR. BARWICK—I would like to ask about the arrangement of the buckets, whether they were at the hub or on the periphery of the fan.

MR. WING—All buckets are placed at the outer edge, so as to get the entire benefit of the leverage.

MR. BARWICK—Has Mr. Wing made any tests of this plan?

MR. WING—Yes, sir, quite a number. I obtained from three to four times the amount of air, using the same amount of steam.

MR. BARWICK—The author says, "by having the damper partially closed, and controlled by a regulator." Where is that placed?

MR. WING—That regulator is a small one, such as those used to regulate the damper and control the fan, driven by an engine or a steam jet.

MR. BARWICK—That is, steam controlled?

MR. WING—Yes.

MR. BARWICK—How would the efficiency compare between this new fan and the ordinary centrifugal fan of the present type we are using?

MR. WING—I am not prepared to say exactly.

MR. QUAY—In next to the last paragraph, referring to dampers, I think the damper is controlled by the same steam pressure that regulates the engine and operates the fan. I suppose that is the intention. So when the damper is open, the speed of the fan is increased and as the speed is increased, the damper closes and lessens the speed of the fan. I presume in this next to the last paragraph, there is something of the same arrangement.

MR. BOLTON—The paper brings up the subject of the relative advantages of methods of burning fuel. Each in its own way has its advantages. The question of forced draft is a large one and so large, I am afraid, if the time of the convention were devoted to it, it would not be thoroughly thrashed out.

MR. BRENNAN—I have put in some of this kind of apparatus and have used the hollow blast grate, having a blower connecting with the engine. I have made a few notes regarding the different amounts of air for different styles of forced draft. I do not know how near right the figures are, but they will allow you to draw a comparison.

I agree with Mr. Wing in his remarks. A properly distributed forced draft will require less air for perfect combustion than would be the case with natural draft. According to experiments, by the late Professor Thurston, to burn a pound of coal in theoretical practice, requires 12 pounds of air, while in ordinary natural draft, we use from 24 to 30 pounds. With a properly distributed forced draft, with fan blower through hollow grates, we use but 18 pounds of air to burn a pound of coal.

Now, simply to make draft with a chimney, we use 6 pounds of surplus air for every pound of coal burned. If a furnace is burning 1,000 pounds of coal per hour, it would, with natural draft, be wasting 6 000 pounds of air per hour, for no use whatever except to create draft. It takes nearly ⅓ of a B. T. U. to warm 1 pound of air one degree in one minute. Therefore, if the temperature of the air at the ash doors is 60 degrees, and the temperature of the uptake is 550 degrees, it would require about 13 per cent. of the total capacity of the boiler to heat this unnecessary air, simply to make a natural draft.

If using forced draft, with a fan blower, and small engine, about 3 per cent. of the boiler capacity is required to furnish power for the operation of the fan. Further, the heated gases of combustion will move through the boiler tubes with greater rapidity when being drawn to the chimney with a strong natural draft, or induced draft, than would be the case with forced draft. Consequently, much of the heat that should remain in contact with the tubes and shell of the boiler, would be discharged from the top of a chimney, and wasted in the surrounding atmosphere.

PRESIDENT KENT—Thus far there has been nothing said about chimney drafts. I want to say something in behalf of the chimney draft. I have obtained good results from chimneys only 40 feet high with natural draft. This was with the horizontal tubular boiler. With chimneys 100 feet high, I have had results which could not be excelled by any forced draft.

The best results on record, with anthracite coal, have been made with chimney drafts. No systematic series of tests have given better results than the Centennial tests of 30 years ago when five boilers of different makes were used. This test resulted in as high figures as can be expected with any boilers under any system whatever.

As to the author's statement "that boiler plants can be made very much more efficient, and gain largely in capacity and economy," I will say it is true that boiler plants can be made to gain largely in capacity by using forced draft, but there is no possibility that they can be made to give better economy than with chimney drafts, if conditions are right.

As to the statement made in regard to the amount of air supply for a pound of fuel, I have made a great many tests and have found that the supply of air varies from 14 pounds per pound of fuel, to 28 pounds in the same boiler, under the same conditions within ten minutes. No one has ever made tests to prove that any better results can be obtained with forced draft than with natural draft, on account of the forced draft supplying less air per pound of coal than the chimney draft.

Forced draft is to correct the difference in pressure between the ash pit and chimney, and the natural draft does that the same as forced draft, the only difference being that when we have a fan, we have capacity, if we want it, to increase the draft and give the boiler that certain draft which is just right for the coal and for the thickness of coal on the fire.

The tendency of forced draft is rather to reduce economy than to increase it.

The fact is, both drafts are supplied by heat wasted, any way. With chimneys it costs nothing to supply the draft because we have to have the chimneys any way to get rid of the gases, and the temperature from the chimney is no higher than it would be with forced draft. So there is no waste whatever in the chimney.

When we come to high chimneys we have to consider the cost, and very high chimneys are exceedingly costly. Engineers have looked into this question thoroughly for the last 25 or 30 years and the power plant engineers are posted on forced draft versus chimney draft. These engineers generally are putting in tall chimneys with fans for reserve, in case they want to run the boilers above their normal rating.

In the Manhattan Power Station, here in New York, they have natural draft through the chimneys and they have fans also, which are standing idle because it is cheaper to run the chimneys without fans than with them. Fans, however, are put in for emergency, which is proper. There is a good deal to be said in favor of the chimney draft.

In regard to the jet blower, I have made tests and found that 10 per cent. to 11 per cent. of the whole steam generated by the boiler was needed to run the fans. The boilers were operated on buckwheat coal and it was necessary to have forced draft to get the power. The economizer, generally, makes it necessary to put in a fan to overcome excess resistance. In the Manhattan Power Station, the chimneys are so high they manage to overcome the friction of the economizers without the fans.

## Installation of Officers

Following the discussion of Mr. Wing's paper, the newly-elected officers were formerly installed by President Kent, who informally addressed the new officers.

"Mr. Gormly," he said, "I have to congratulate you upon your election to this honorable position of President of the American Society of Heating and Ventilating Engineers. The best I can hope for you is that you will be treated in that position as I have been, and I hope you will enjoy fulfilling the duties of your office.

"Mr. Mackay, if he will be as good a secretary as he has been, will do all that you can ask of him.

"Mr. Scollay will take care of the funds and make up all deficiencies.

"Mr. James Mackay represents the wild and woolly West and we are glad to have him here to look after the next meeting in the West.

"Mr. Chew, we are glad to have a representative of the press with us."

President Gormly, in assuming the chair, said:

"I think at this time you would rather continue business than have any speech making. I will say this to you, however, that I know there are a great many of our members whose minds are stored full of valuable information and it will be our earnest endeavor to get that out of them the coming year. Some of you may be too busy to give your time to the preparation of a paper as you would like to prepare it. If you will be kind enough to send the matter in to us, we will make an effort to prepare it for you. We will try to give it the time because we feel it is an absolute necessity to get matter of that kind here. That is what we are associated for and the more of it we get and the more it is discussed here, the more this organization will benefit each member."

President Gormly then announced the appointment of the regular standing committees, as follows:

COMPULSORY LEGISLATION

T. J. Waters, Chicago.
H. D. Crane, Cincinnati.
C. H. Basshor, Baltimore.
Andrew Harvey, Detroit.
W. H. Bryan, St. Louis.

STANDARDS

Prof. Wm. Kent, Syracuse, N. Y.
W. F. Wolfe, Philadelphia.
Prof. J. H. Kinealy, St. Louis.
R. P. Bolton, New York.
E. F. Capron, Chicago.

TESTS

Prof. James D. Hoffman, Lafayette, Ind.
Wm. G. Snow, Boston.
H. A. Loeb, Philadelphia.
S. G. Neiler, Chicago.
C. R. Bradbury, Washington, D. C.

Following this, the subject of special committees was taken up and those appointed as stated on another page.

There was also further discussion at this point of the place for holding the summer meeting, which, as noted, crystallized in favor of the West.

## Topic No. 5

*The Advantages and Disadvantages Attending the Use of the Thumb Rules.*

MR. BERRY—Did the Society in past years ever have a paper prepared giving any of the thumb rules for estimating or the methods of determining the size of apparatus, etc.?

PRESIDENT GORMLY—So far as the Chair knows, it never has. I have no doubt the Society would be willing to accept anything of that kind.

MR. KENT—Our transactions contain many thumb rules and I think nearly everyone uses them. We heard one today, that the returns should be one size smaller than the steam riser. That, I

understand, is a thumb rule and allows a reasonable profit to the contractor.

As to the question of advantages and disadvantages attending the use of the thumb rule, the advantages are that they are exceedingly easy to work with. Their disadvantages are, that they do not take into consideration all the various circumstances and very often they are apt to be inaccurate. They are good and useful, but don't fill the requirements of modern practice.

### Topic No. 6

*The Effect of Exhaust Fans for Ventilating Rooms Heated by Direct Radiators.*

MR. JAMES MACKAY—Some years ago, I heard some of the largest manufacturers of radiators in the country make some claims in reference to the use of exhaust fans in rooms heated by direct radiators. I have seen them put fans under a direct radiator and get good results. I do not know that there is anything very reliable or very certain in the way of experiments upon this subject that have come to my notice.

MR. QUAY—Years ago I had occasion to use fans to heat the vestibule of a large store. We used them with direct radiators for two or three reasons. One was on account of the doors and the other was that we could not get enough direct radiation. The results were excellent. The owner himself made the suggestion.

Where doors are continually opening and closing, there is a strong current of cold air coming in, and, of course, it is hard to heat that part of the store. With the fans I was able to get the desired amount of heat in the vestibule. Of course, it was run at a low speed or a high speed, to suit conditions.

MR. JAMES MACKAY—Not exhaust?

MR. QUAY—No, sir.

After some further discussion, the society adjourned.

## The Organization of Board of Governors

Immediately after adjournment, the Board of Governors met and organized, with President John Gormly as Chairman and William M. Mackay as Secretary. The Chairman appointed the following sub-committees:

Finance Committee—James Mackay, B. F. Stangland and Frank K. Chew.

Membership—T. J. Waters, C. B. J. Snyder and A. B. Franklin.

Publication—R. C. Carpenter, Frank K. Chew and W. M. Mackay.

Executive—C. B. J. Snyder, W. M. Mackay and B. F. Stangland.

## Heating Engineers' Annual Dinner

Fully 150 heating and ventilating engineers, with their friends and guests, gathered in a large dining-room of the New Grand Hotel, New York, on the evening of January 17, to partake of the annual dinner of their Society. The dining-room was arranged most attractively with many small round tables placed in front of the main speaker's table. The dark wood finish of the room and subdued lights, radiating from half-concealed electric bulbs, served to give the room a most inviting aspect.

After discussing an interesting menu, the toast-master, President Kent, arose and announced the first of the list of toasts, which was "The Heating Engineer of the Future," to which Professor R. C. Carpenter responded, saying, in part:

"The future is a sealed book. We can judge of it only by the past. In the early days, there was a very great difference between theory and practice. There was very good theory and very bad practice. Theory and practice must go together. The good theoretical man must be a good practical man. Proper methods of heating and ventilation will do more to prolong the life of man than any other one thing."

Mr. James Mackay, of Chicago, was next called upon to tell what the West thinks of the Society.

"We feel in the West," said Mr. Mackay, "that this Society is doing great good, but that it is not as representative as it should be. An association bounded by the borders of New York is the way many people in the West look at it. The holding of the semi-annual meeting in the West is good for the Society and good for the West."

Mr. John Trainor, an ex-president of the National Association of Master Plumbers, was then called upon to explain, if he could, the toast, "The Plumber as a Heating Engineer." Mr. Trainor, instead, told how he had watched the career of the Master Plumbers' Association from its birth and of a wonderful improvement in sanitary work which he had witnessed. He predicted a continued era of progress for the heating engineers' society.

Mr. A. B. Franklin was next introduced to speak for the National Master Fitters' Association. He described the labor troubles through which the master fitters of Boston have been passing and which have resulted in the establishment of the open shop in that city. Then turning to the technical side of the heating engineers' work, he said:

"The day has gone by of withholding information in our profession. The public needs information. Engineers should educate the public in every way they can. The more we can educate the public, the better it will be for our business and the more the work we are doing will be appreciated. You offer a man a good system, but out of lack of knowledge, sometimes, he does not accept it, simply because the cost appears to be high. After

he has had cheaper work done, then he understands the case and he says, 'Why didn't you tell me?' Charles W. Newton, of Baltimore, was the first man who would tell me, then a young man, what he knew in response to my questions. So don't conceal your knowledge. I believe we are doing God's work when we take a residence and make it warm and comfortable for a man's family and children."

Mr. John Gormly, of Philadelphia, the new president, was the following speaker. He said, among other things:

"I have watched this organization from its inception and I believe there is very much good work ahead of it. The Society should embrace the work being done by the Refrigerating Engineers and they should join us. The Society's standard is very high and the keeping of that standard depends on its membership, upon you. I trust that all will begin now to lay plans for papers for our next meeting. Many of you, I know, are walking encyclopedias of knowledge."

The next toast was "The Commercial Side of the Heating Business," to which Mr. C. V. Kellogg responded. "Speaking from a manufacturer's point of view," he said, "there is, just now, no commercial side to the heating business." Mr. Kellogg referred to the tendency of marketing goods through illegitimate means, such as department stores, and added:

"To-day the buyer, specifier and honest paymaster have more to do with the making of the market than anyone else. There is no agreement between manufacturer and buyer that would make commercialism. Both should build up commercialism and make it as legitimate as theory and practice."

Ex-Senator Albert A. Wray, who was influential in securing the passage of the New York Ventilation Law through the State Legislature, was next called upon and made a witty speech, thanking the Society for its hospitality.

Mr. Andrew N. Harvey, who presided at the tenth anniversary meeting, was asked to say something regarding the twentieth anniversary. Mr. Harvey confessed his inability to fill that contract, but kept the diners in a jolly frame of mind with some typical Scotch stories.

Mr. T. N. Thomson, of the International Correspondence Schools, Scranton, Pa., was called upon to respond to the toast "Educational Opportunities." Mr. Thomson said:

"Of the 800,000 students taking our courses, 25,000 are studying heating, ventilating and plumbing." Mr. Thomson spoke of the care involved in preparing courses of study to fit the varying needs of the students, and related some amusing experiences in connection with the way some of the questions were applied.

The toast-master then called upon Mr. Hugh J. Barron, who rose to say:

"Gentlemen, the toast-master told me I was not to be called on unless something was said against the Irish." Mr. Barron then presented the position of union labor, as he understood it, and expressed his opinion that the subject of the open and closed shop was one that was far from being settled, and that the labor union had come to stay.

The last speaker of the evening, Mr. Frank N. Chew, responded to the toast, "The Press." Mr. Chew referred to the anniversary of the birth of Benjamin Franklin, which had been referred to by the toast-master. Mr. Chew said that, as a newspaper man, he took pride in the fact that Benjamin Franklin was first a newspaper man and then a heating and ventilating engineer.

## New Jersey's Ventilation Law

Under the heading of "New Jersey's School Laws, Revision of 1903," there has come to light a section regulating the ventilation of school houses, which the American Society of Heating and Ventilating Engineers has been working for many years to secure, the passage of which has only recently come to the attention of the Society or of heating and ventilating engineers generally. The act is known as the Stokes law, having been introduced by the present Governor of New Jersey, and the passages containing the ventilation requirements for public school buildings are fully as stringent as the present laws of New York or Pennsylvania.

The ventilation requirements appear under Article X, Section 131, the first three paragraphs of which read as follows:

I. Light shall be admitted from the left or from the left and rear of classrooms, and the total light area must, unless strengthened by the use of reflecting lenses, equal to at least 20 per cent. of the floor space.

II. Schoolhouses shall have in each classroom at least 12 square feet of floor space and not less than 200 cubic feet of air space per pupil. All school buildings shall have an approved system of ventilation by means of which *each classroom shall be supplied with fresh air at the rate of 30 cubic feet per minute for each pupil.*

III. All ceilings shall be at least twelve feet in height.

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ONE of the pleasantest surprises of the recent meeting of the heating engineers was the discovery of a ventilation law in New Jersey that measures up close to the restrictions of the laws in force in New York and Pennsylvania. The society has long worked for such a law in New Jersey, but had, as was thought, met with no success. It now appears that the bill, in which the society took such an active interest, passed the Legislature in 1903, and it has been on the statute books ever since.

The lack of knowledge concerning this bill on the part of the society is partly explained by the fact that it is tucked away in the "New Jersey School Laws, Revision of 1903, an act to establish a thorough and efficient system of free public schools, and to provide for the maintenance, support and management thereof. Approved October 19, 1903." The clause referring to ventilation requirements is found well along in the act, under Article X. There is, however, no reference to it in the index. The text of the clauses referring to the ventilation will be found on another page. It is of interest to know that the present Governor of New Jersey, Governor Stokes, at that time a member of the Legislature, is the father of the bill, which is known as the Stokes Act, and it is to him that the profession is indebted for this satisfactory measure.

THE widespread sentiment among heating engineers that they should hold the midsummer meeting of their society in a Western city can almost be taken as a sign of the times, and it will not surprise anyone if the results that follow this course will mark a new era in the development of the society, numerically, to say the least. A few Western members, present at the recent New York meeting, told in convincing terms of the opportunity that awaits the society in the West, as well as the benefit that would accrue to the profession as a whole as a result of the intermingling of Eastern and Western ideas. It is to be doubted, therefore, that the efforts of some of the enthusiastic Eastern members to lure the society to the seashore will prevail in view of this plain path of duty that has been laid out, pointing Westward.

HOLDING Western meetings occasionally is an idea that some of the other engineering and trade societies would do well to take up again. Indeed, a meeting in a Western city, such as took place at Atlantic City in 1902, when the heating engineers, master fitters and master plumbers assembled during the same week, would, per-

haps, prove the critical step towards the time when the members of these professions, not in the ranks of their organizations, will be at last in the minority. From present indications it would seem to lie with the West to provide a meeting place sufficiently attractive to dispel the allurements which Atlantic City still wields on the trade.

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ONE of the Lake cities, such as Detroit or Cleveland, would make a good convention city, and rumor already has it that the choice for the Master Fitters' Convention may, after all, fall in another direction than that of Atlantic City. If this should prove true it will be a deserved acknowledgment of the recent increase in membership in the Middle West, which has been secured under the administrations of Presidents Henry L. Hall and P. Gormly.

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THOSE who are watching the course of the latest "crusade," both in England and America, to secure the adoption of the metric system, will be interested in the remarks made upon this subject by President A. Nelson Haden, of the British Institution of Heating and Ventilating Engineers, in his recent address before that body. Mr. Haden is doubtless familiar with the well-known arguments of those who are decrying the present system of measurements, and his refreshing remarks upon the subject must sound like "rankest heresy" to the meter advocates.

He had no hesitation, he said, in expressing it as his opinion that a decimal system would be eventually adopted in England, "but," he added, "it is by no means assured that that unit will be the meter. He then called attention to the disadvantages of a unit so inconveniently large as the meter, and quoted many opinions of English engineers who were in favor of the use of the British inch. "If the United States," he concluded, "who use the inch as we do, joined the British Empire in the adoption of a British unit on the decimal system, it would probably in time become universal."

We took occasion to say in a recent issue that not one reputable engineer in a hundred on this side of the water has considered it practicable, or even possible, to adopt the metric system in the United States to the exclusion of the present standards of measurement. Judging from the tenor of Mr. Haden's remarks, it would seem that this view prevails to a similar degree in England.

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"CALORIMETRICAL Methods of Determining Heat Losses from Buildings and Radiators," a paper read by Mr. A. H. Barker before the British heating engineers, was written in a way that could not fail to arouse discussion. In some of his statements Mr. Barker throws a sharp challenge to the radiator manufacturers and points out what he terms incorrect methods of calculating radiator efficiencies as used both by the manufacturer and the engineer. The problem he presents of estimating the required radiation for a room, under difficult but not unusual conditions, and his unique method of solving it, is most interesting.

# Annual Meeting of the British Institution of Heating and Ventilating Engineers

**London, England, January 16, 1906**

Two papers were on the program for the annual meeting of the British Institution, which met, as before, in the rooms of the Institution of Mechanical Engineers, Storey's Gate, St. James Park, London, January 16 last. One of these papers was presented by A. H. Barker, and was entitled "Calorimetrical Methods of Determining Heat Losses from Buildings and Radiators." The other paper was by E. W. Mayner on "The Ventilation of Greenhouses," but so much time was taken up in the discussion of the first paper that Mr. Mayner's paper had to go over to the summer meeting.

Awards of silver and bronze medals of the institution to O. M. Rowe and Professor Barrett, respectively, were announced for the best papers presented during the past year.

### THE METRIC SYSTEM NOT PREFERRED

President A. Nelson Haden, who occupied the chair, welcomed the members in a carefully prepared address, in which he referred to the agitation in connection with the proposed establishment in England of the metric system. He expressed himself as of the opinion that a decimal system would be eventually adopted in England, but it was by no means assured that that unit would be the meter. Mr. Haden called attention to the disadvantage of a unit so inconveniently large as the meter, and referred to the opinion of many engineers favoring the use of the British inch. "If this inch were adopted," he said, "as the unit of measurement, our new standards, which were drawn up in inches, would need no alteration if we used thousandths of an inch as sub-divisions, which are used almost universally for gauges. If the United States, who use the inch as we do, joined with the British Empire in the adoption of a British unit on the decimal system, it would probably in time become universal."

### SUGGESTED IMPROVEMENTS IN DRAWING HEATING PLANS

As an improvement in the drawing of heating and ventilating plans, Mr. Haden suggested the use of isometrical drawings, showing not only the location and sizes of all the pipes and radiators, but the estimated heating surface and calculated temperature of the radiators. The object of this would be that on the completion of the work the temperature could be taken at each radiator and comparisons be made with that calculated as shown on the plans.

W. NELSON HADEN

President, British Institution of Heating and Ventilating Engineers

A suggestion was made that the summer meeting of the Society be held at Bath, England, June 19-20 next.

Mr. Barker's paper is presented herewith.

# Methods of Determining Heat Losses from Buildings and Radiators

By A. H. Barker

The problems presented to the heating engineer are dual in character. He has to determine, in the case of each room treated, what is the number of B. T. U. lost to that room when maintained under the conditions required by the specification, and, secondly, how best to supply that amount of heat to the room.

Both from a scientific and practical standpoint the actual amount of radiating surface is a secondary consideration—secondary in the sense that the required

degree of temperature can be secured in a room by an amount of surface considerably less than it is advisable to put in—and that the heat delivered into a room is a quantity far more dependent on the power of the boiler and the arrangement of mains than it is on the heating surface of the radiator in the room.

### HEAT LOSSES LARGER THAN THEORETICAL ESTIMATES

Why is the amount of heat lost from a room so much larger than scientific theories lead them to believe? Except as an element in an approximate calculation it serves no practical purpose even to consider how much heat is lost by pure conduction, properly so called, because pure conduction is a phenomenon unknown in practical heating. It is always accompanied by convection of heated air and percolation through walls.

In nine cases out of ten a specification in Great Britain demands an internal temperature of 60 degrees, with an outside temperature of 32 degrees. To allow a little margin for safety it is well to reckon a rise of 30 degrees. No mention is made in most cases of the amount of interchange of air required, and even when this is done, who is to estimate or determine how much air actually passes into or out of a room?

### PROPER AND IMPROPER METHODS OF MEASURING INCOMING AIR

The best method in testing rooms provided with ventilating gratings is to hold the anemometer face over each of five selected positions in turn for 12 seconds, making one minute in all. To hold the anemometer in the center of the grating, as is the common method, is futile, because the center of the grating is the region of the greatest velocity, and this method always gives from 25 to 50 per cent. more air than is actually passing. The presence of the anemometer itself, and especially of the hand holding it, exercises a disturbing effect on the actual unimpeded flow of air, so that anemometric observations as carried out in practice give anything but a close approximate to the actual quantity of air passing.

But even assuming that by means of an anemometer it is possible to determine practically and with some approach to accuracy the total quantity of air passing up the flue, there still remains the wholly unknown quantity of air passing in and out through the substances of the walls. It is impossible to say precisely how much air passes through the walls of an ordinary room. Some authorities state that as much as three changes per hour pass through the substance of ordinary brick plastered walls of a room of this size.

### IMPORTANCE OF CHARACTER OF THE HEATING SURFACE

It is a common practice among engineers to determine the amount of heating surface required in a room either from the contents alone or from the glass, roof or wall area without any inquiry either as to what is to be the character of the heating surface, how it is to be fixed, or, more than all, what is to be its temperature. All these matters are of such extreme practical importance that it is by no means an infrequent experience to find in the same installation two radiators of the same surface, one of which gives off three times the amount of heat as the other.

Many text books proportion the heating surface to the glass, wall and roof area without specifying the temperature or the character or position of the radiating surface. Most boiler catalogues give the power of the boilers in "feet of radiating surface or feet run of 4-inch pipe," and that without specifying the temperature of the surface. In fact, 1 foot of 4-inch pipe gives off at least 50 per cent. more heat at the same temperature than a square foot of ordinary radiating surface. How important this matter is appears from an inspection of the accompanying table, which gives the heat emission from different classes of radiators differently placed.

### RADIATORS PLACED CLOSE TO WALLS ARE PROTECTED FROM SOME HEAT LOSSES

When a radiator is fixed close to a wall the wall in a few hours becomes heated to a considerable temperature and this warm wall protects the radiator to a large extent from loss of heat in the back. When a radiator is fixed in a recess the case is still worse. If the radiator is surrounded by a plinth preventing an excess of air to the back the effect is still more marked. Yet our authorities continue to test their radiators fixed on a stand 3 feet high in the middle of a room and give out the results for use by heating engineers, who hardly ever fix their radiators otherwhere than against a wall or in a recess. When radiators are fixed in front of a fresh air opening the amount of heat lost depends entirely on the amount of air passing over the surface of the radiator. I made a test on two successive days on the same radiator in the same room, with the same outside temperature, the sole difference between the two sets being the amount of air passing over the back of the radiator, which was arranged to be accurately controlled. The difference between the two results was 42 per cent.

### LABORATORY TESTS MISLEADING IF NOT UNDERSTOOD

I do not wish to depreciate the value of scientifically conducted tests made in a laboratory. These tests are of the

greatest value when properly understood, but unless they are properly understood they are often quite misleading. Figures obtained by laboratory tests representing the relative values of different forms of radiators, such as single, double and three-column radiators, are of the greatest value as the relative proportion of efficiency held approximately, however the radiators were fixed. Radiators ought to be catalogued according to their efficiency and not according to their nominal or actual surface.

### TEMPERATURE OF RADIATORS SHOULD NOT GO ABOVE 120°

The question of the temperature at which radiators are maintained is indeed one of the chief factors in the success or failure of a heating apparatus. I have an objection to occupying a room heated by radiators at a higher temperture than 140 degrees; 120 degrees is preferable. Probably much of the prejudice against heating apparatus in England arises from the overheating of radiators, causing smell and giving rise to the complaint that radiator heated rooms are stuffy. To heat a room up to, say, 60 degrees from 30 degrees is possible by hot water radiators of any surface from about total heat units required divided by 260 upward; 258 represented the number of heat units given off from 1 square foot of a radiator at 200 degrees F. If the temperature is lower more heating surface was required for the same effect.

All the heat transmitted by the furnace to the water in the boiler must be dissipated in the building and the temperature of the radiator rises to such a point that all that heat is so dissipated. The crucial point, then, is so to arrange the mains that it is dissipated at the points where it is required and in such a proportion that no room is overheated and no room left cold.

### POWER OF BOILER SHOULD BE CALCULATED IRRESPECTIVE OF RADIATING SURFACE

Thus the power of an apparatus is represented by the power of the boiler, provided the surface of the radiators and the disposition of the mains is such that the radiators are maintained at the temperature at which they give off in the building all the heat transmitted by the boiler plates to the water. Since the heat required to be given off at the radiators is the same as the amount given off by the building when maintained at the required temperature, the power of the boiler must be the same as the heat lost from the building, so that the power of the boiler should be calculated quite irrespective of the amount of radiating surface, which is, as had been shown, only a secondary matter.

**HEAT EMISSION FROM RADIATORS AT VARIOUS TEMPERATURES WHEN FIXED AGAINST OUTSIDE WALL, NOT VENTILATING.**

| Temperature of Radiator, Degrees F. | Difference of Temperature Between Radiator and Surrounding Air. | Single Column. Height, Inches. | | Double Column. Height, Inches. | | Three Column. Height, Inches. | |
|---|---|---|---|---|---|---|---|
| | | 26 | 38 | 26 | 45 | 26 | 45 |
| 100 | 40 | 54 | 50 | 50 | 43 | 47 | 41 |
| 110 | 50 | 70 | 66 | 65 | 55 | 61 | 53 |
| 120 | 60 | 88 | 83 | 81 | 69 | 76 | 66 |
| 130 | 70 | 106 | 100 | 98 | 84 | 92 | 80 |
| 140 | 80 | 125 | 117 | 116 | 100 | 108 | 94 |
| 150 | 90 | 145 | 136 | 134 | 116 | 126 | 110 |
| 160 | 100 | 165 | 155 | 153 | 132 | 144 | 126 |
| 170 | 10 | 187 | 175 | 173 | 148 | 162 | 142 |
| 180 | 120 | 209 | 196 | 193 | 165 | 182 | 159 |
| 190 | 130 | 232 | 217 | 215 | 183 | 202 | 177 |
| 200 | 140 | 256 | 240 | 237 | 201 | 222 | 195 |
| 210 | 150 | 280 | 264 | 260 | 221 | 243 | 213 |
| 220 | 100 | 306 | 281 | 284 | 241 | 265 | 231 |

### MAINS SHOULD BE CALCULATED IRRESPECTIVE OF SURFACE OF RADIATORS

Also, the mains should be calculated irrespective of the surface of the radiators they supply. If a room requires, say, 9,000 heat units per hour, then a main should be put in which will carry a sufficiency of water without losing more than, say, 30 degrees in temperature—that is, it should circulate $9{,}000 \div 30 = 300$ pounds, or 36 gallons of water per hour. Provided the radiator has a surface of at least $9{,}000 \div 170$ inches, or, say, 53 square feet, it would dissipate this amount of heat at a temperature of 180 degrees, the same proportion being observed throughout. If radiators double the surface mentioned were put in throughout the whole installation the same amount of heat

would be given off, but it would be given off at a lower temperature, at, say, 120 degrees, instead of 180 degrees. The amount of radiator surface determines the degree of comfort and not the temperature of the rooms.

The chief need at the present time is a more accurate knowledge of the amount of heat lost from a room, and that can only be roughly calculated from existing data. The chief element of uncertainty is the amount of heat passing away by irregular ventilation, and it is to this point that attention should be directed.

### A HEATING PROBLEM

Let us assume for purposes of illustration that they had a large existing drawing room of 25,000 cubic feet of irregular shape, with many recesses and outside walls and a roof the character of which as regards heat transmission could not be readily determined, and assume further that it was specified to be heated by radiators fixed in recesses behind a dado to 62 degrees and no more, with an outside temperature of 28 degrees, when the temperature of the radiators did not exceed 140 degrees and with a large open fire at one end of the room. To make calculations from any existing data which would enable this problem to be exactly solved was probably impossible. There was no single item of the calculations which could be exactly determined. Who was to calculate the heat lost from an existing roof which might or might not be porous, or from walls the substance of which was unknown? Who could estimate how many thermal units per hour would be emitted by a "large fire" at one end of the room? Who was to prophesy exactly how much heat may be expected from radiators fixed in a recess and behind a dado? It was pretty safe to state that most heating engineers would solve the problem by fixing more surface than could in their opinion possibly be required, trusting to luck for good results. The method I have referred to would solve the problem exactly and in as simple a manner as it could be solved.

### ONE WAY TO SOLVE THE PROBLEM

In the first place a rough estimate should be made of the number of thermal units per hour that would be needed. Probably a room of the character and size mentioned would not require more than 100,000 heat units per hour to maintain it at 62 degrees. Now a pound of ordinary petroleum by complete combustion gives off about 22,000 heat units per hour. Half a dozen specially designed petroleum stoves and a plentiful supply of petroleum—a sample of which should be tested carefully with a calorimeter to ascertain its exact thermal value—would be required for the test. The stoves should each be placed under a large piece of thin sheet iron fixed horizontally for distributing the hot gases from the stove.

### PRELIMINARY EXPERIMENTS

The experiment should be made on the worst day that could be selected, as near as possible to the conditions of the specification, a large fire being maintained in the grate and all other factors kept in the same state as they might be expected to be when the room was in actual use under severe conditions. The stoves might be as near as possible in the position which the radiator would occupy; into each a weighed quantity of petroleum should be put. These stoves and the fire should be kept alight day and night for at least 24 hours, careful observations being made by thermometers hung in the room during the whole period. If any thermometer read higher than it ought, the stoves in its vicinity should be turned down, and if any read lower, the corresponding stoves should be turned up. They should be continuously adjusted until an even and constant temperature of 62 degrees was secured all over the room. Meanwhile the amount of petroleum burned per hour in each stove should be carefully observed. This value multiplied by the thermal value of the petroleum would give the number of heat units required at each point under working conditions. That is the first part of the investigation.

### DETERMINING SIZES OF RADIATORS

The second consists in the determination of the sizes of the radiators which, when fixed in the manner required, would give in each case the required number of heat units. This investigation might be carried out at the works. To do this a radiator should be mounted in exactly the manner that the radiators in the finished job would be mounted. Two tanks should then be fixed in its vicinity at different levels. Under the bottom one would be fixed a petroleum stove or a steam pipe or other means of heating the contents of the bottom tank to any desired degree, with a pump for forcing the water from the bottom to the top. The water in the bottom tank should then be heated, to, say, 5 degrees above the required temperature and pumped up into the top tank. The water from the top tank should then be allowed to flow by a pipe from the top tank into the radiator and from the radiator into the bottom tank, the pipe being provided with a valve so that it could be adjusted to any required flow. Then the valve should be adjusted until the water in the return pipe was as much below the required temperature of the radiator as the water in the tank was above that temperature, temperatures being taken at inlet and outlet of the radiator.

The weight of water in pounds flowing per hour through the radiator multiplied by the number of degree difference

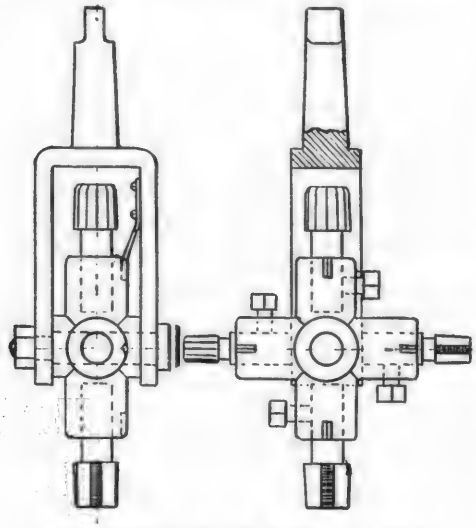
between the flow and return pipe would give the number of heat units per hour given off by the radiator. A certain part, however, of this heat would be lost from the wall at the back of the radiator. This amount could be estimated with sufficient accuracy from the conductivity of the wall. As the total amount was not large, an ample margin might be allowed on this account. All other heat emitted from the radiator must escape into the room. The size of radiator therefore necessary to give the amount of heat required could be determined with some approach to accuracy.

# CORRESPONDENCE

### The Inventor of the Monitor Lathe

Editor HEATING AND VENTILATING MAGAZINE:

In the December issue of THE HEATING AND VENTILATING MAGAZINE, there is an article regarding globe valves and who invented the monitor lathe. I think the first idea of that machine was conceived by Mr. Joseph Nason. It was in use in his shop when the writer was in his employ in 1865. The enclosed sketch shows



REVOLVING CHUCK FOR REAMING AND TAPPING (1865)

the revolving chuck. It contained the reamers and taps of different sizes. After reaming a hole, it was pushed around with a stick to get the tap in position without stopping the machine. Having that idea in a tool shop, the designer has probably developed it into the monitor lathe. A. C. CHRISTENSEN.

New York, Jan., 1906.

# NEW DEVICES

### The K-M-C Manual Retarder

A new device in connection with the K-M-C Vacuum Steam Heating System is a manual retarder illustrated herewith, which permits a free flow of air from the pipes and radiators to the air line, but offers a resistance to the passage of steam or water. It is designed to serve the same purpose as a vacuum air

MANUAL RETARDER FOR K-M-C VACUUM STEAM HEATING SYSTEM

valve. It has no stuffing box or packing and its operation is due to the movement of a disk of helmut metal. A light movement of the wheel opens and closes the retarder. It is also self-cleaning and is used on radiators which are provided with valves; thus, by closing the retarder and the valve, the radiator can be completely isolated from the rest of the system.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

### State Organization for New Jersey

A state organization was formed January 16, in Newark, N. J., which will be known as the New Jersey State Association of Master Steam and Hot Water Fitters. The officers of the association are as follows: President, Sol Berla; vice-president, Joel S. Boyce; secretary, Harry W. Geiser. The Board of Governors are: T. B. Cryer, E. R. Soleau and Andrew F. Van Cleave. The Committee on By-Laws: E. B. Denny, chairman; R. Berla, Geo. Turner, Chas. Walton and Wm. Whitlock. President P. Gormly was present at the launching of the new body.

# TRADE AND MISCELLANEOUS NOTES

### Trade Literature

**Roofing Rules** is the title of a handbook on sheet metals, in building construction for the use of architects, owners, engineers and builders, published by Merchant & Evans Co., successor to Merchant & Co., Philadelphia, Pa. It contains descriptions of the qualities of roofing and classes of roofing, together with the processes used in the manufacture of the metal. The book contains many half-tone illustrations. Size, 8x5½ inches. Pp. 60.

**Lunkenheimer Company's** illustrated catalogue and price list for 1906 is out. In presenting the catalogue to the trade, the company anounces the addition to its line of many new specialties, which are shown in the new catalogue. Also included in the book are many half-tones of the Lunkenheimer plant, showing some of the various processes through which the goods pass in the course of manufacture. Under the heading of "Tables and Useful Data," is included an unusual amount of tabulated information for reference purposes. Size, 7¼x5 inches. Pp. 472.

### New Firms

**Baltimore Plumbing & Heating Co.,** Baltmore, Md., is the name of a new firm at 7 Clay street. Christopher Lauterbach has undertaken the management.

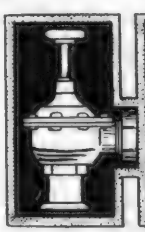
### Manufacturers' Notes

**Crane Co.,** Chicago, Ill., has bought the business of the Thomas Hoey Supply & Manufacturing Co., of Boston, Mass. The liabilities of this company amounted to $161,601, and the assets, $212 948.

**Banfield-Vesey Fuel Co.,** Portland, Ore., has purchased property here for about $90,000 to erect a plant which will furnish steam heat through pipes to the business section of the city.

**Sayles Co.,** New York, has had two petitions in bankruptcy filed against it. The company was located at 446 Fourth avenue and were steam heating contractors.

**Kingsley Water Tube Boiler Co.,** New York, is arranging to spend about $100,000 in building and equipping a new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POST YOUR SELF MARVELOUS FUEL SAVING
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Kellogg-Mackay-Cameron Co. SOLE OWNERS
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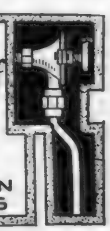


The Albany Return Steam Traps

have been the **STANDARD** for over **THIRTY-TWO YEARS.** For returning water under pressure to the boiler, they will perform this duty fully as well, and in many cases better than the so-called steam loop.

Send for circulars A, B, C and D.

MANUFACTURED BY
ALBANY STEAM TRAP CO., ALBANY, N.Y.
FREDERICK TOWNSEND PRESIDENT
JAMES H. BLESSING GEN. MGR.

plant. This company has just been incorporated to manufacture high pressure boilers and is headed by Wallace Downey, formerly of Townsend & Downey, of Shooter's Island.

**L. O. Koven & Bro.,** New York, are making extensions to their plant in Jersey City, N. J. The new ground, occupying a city block, has been purchased and plans are being prepared for the erection of the plant.

**Little Rock Heating Co.,** Little Rock, Ark., is making extensive improvements in its plant, under the directions of the receiver, J. A. Trawick. Equipment will be installed which will permit the company to use the exhaust steam from the power house of the street railway company. A 500 H. P. boiler, a circulating pump and an additional heater condenser have been ordered, which, according to Mr. Trawick, will double the capacity of the plant.

**American Radiator Company** announces the following addition and changes to the list of its sales offices throughout the United States:

The New York branch and office has been removed to 104-108 N. 42d street into a new and commodious six-story building, recently erected by the company, in which far better facilities have been established for serving the trade and public in New York city and vicinity.

A new office and salesroom has been opened at 11 North Forsyth street, in Atlanta, for the accommodation of the trade in that city and vicinity. A line of samples of Ideal boilers and American radiators will be displayed in the salesroom. Extensive warehouse facilities have also been established at this point.

A new office and salesroom has been opened in the city of Indianapolis, at 511 Lemcke building, for closer co-operation with the trade in that city and vicinity.

On February 1 the Cincinnati branch was removed to a building owned by the Longworth Estate at 213 W. 4th street in order to obtain larger quarters necessary for the growing business of this branch.

**Abendroth Bros.,** Port Chester, N. Y., are enlarging their plant by the erection of a new building, 50x100 feet, and six stories high, to provide added facilities for the manufacture of a new line of boilers.

**Central Foundry Co.,** New York, announces the election of J. B. Murphy as vice-president of the company. Mr. Murphy is president of the Murphy-Dugger-Clark Co., Chicago, Ill., and will therefore spend portions of his time in both Chicago and New York.

**Novelty Iron Co.,** Canton, Ohio, announces the resignation of its president, Mr. William E. Sherlock, which took effect on December 30. At that time Mr. Sherlock was presented with a handsome diamond ring, a token of the esteem of his employees. The workmen, through Mr. Sherlock, also presented John L. Barry with a gold watch, chain

# Wing's Disc Fans

## FOR FORCING OR EXHAUSTING AIR

The Original
The Strongest
The Most Efficient

Send for Catalogue and Reference List of some 800 names of users.

MANY THOUSANDS IN USE

**L. J. WING MFG. CO.**
**136 Liberty Street, New York**

Manufacturers of

**WING'S Disc Fan and Combinations**
**WING'S Fans and Turbine Engines for Forced Draft, etc.**
**WING'S High Speed Steam Engines**
**WING'S Acetylene Generators, etc.**

and charm. Henry E. Sherlock takes over the management as president of the firm, while Curtis E. Hahn assumes charge of the office and correspondence, and Jacob Stiner becomes the superintendent.

### Business Changes

**Schaeffer & Budenberg Mfg. Co.,** 25 Dey street, New York, has moved to its new plant at Foxboro, Mass. Otto Arnold, Jr., who is president of the company, will be in charge, while the New York office will be in charge of the vice-president, E. Bultmann, and also R. E. Frommeyer, and will be used as a general sales office.

**Central Heat, Light & Power Co., Ltd.,** Montreal, Can., has been incorporated with a capital of $500,000 to carry on the business of the Home, Light & Power Company, in all its branches. The company is composed mostly of Montreal capitalists.

**George H. Hersey & Sons,** New York, have purchased the foundry of the Allen Van Nest Co., Flemington, N. J., and are manufacturing the A. & V. boilers. Some time ago they purchased the business of the Pratt Engineering Company.

**Earl & Cook Co.,** New York, has been incorporated with a capital of $25 000 to manufacture apparatus for heating, ventilating, etc. The incorporators are: John L. Earl, Newark, N. J.; Elwood Cook, Verona, N. J.; Dominick E. Dempey, Oswald J. C. Rose and Charles E. Williams, Geneva, N. Y.

**John W. Mellott Mfg. Co.,** Camden, N. J., has been incorporated with a capital of $10,000 to manufacture hot air furnaces and deal in general hardware, tin and slate roofing. The incorporators are: John Wiley Mellott, John Hood Gould, Philip B. Shirey and Ulysses Grant Cook.

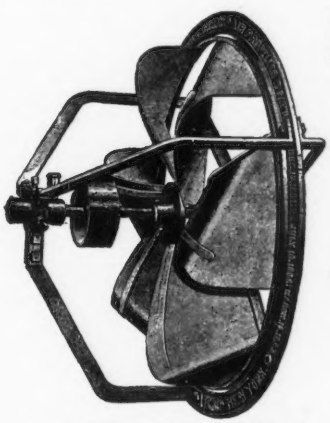
**Garrett-Elliott Hardware & Heating Co.,** Denver, Colo., has been incorporated with a capital of $25,000. The incorporators are: Francis E. Garrett, James R. Elliott and Charles Thorpe, all of Denver.

**Wyman & Gordon Co.,** Worcester, Mass., has been incorporated with a capital of $300,000 to manufacture drop forgings. The president is Lyman F. Gordon and the directors are: George F. Fuller and Horace Wyman.

**Patent Hot Water Heating Co.,** Washington, D. C., has been incorporated with a capital not less than $15,000 and not more than $150,000 to manufacture and sell heating systems, furnaces, stoves, etc. The incorporators are: H. T. Offterdinger, president; H. Gardner, secretary; D. H. Fenton, vice-president and treasurer, all of Washington.

**Patterson & Stewart,** Springfield, Ill., have been incorporated with a capital of $10,000; heating, lighting and refrigerating. The incorporators are: Frank U. Patterson, Desmond M. Stewart and Julian L. Humphrey.

**T. B. Bennett & Co.,** Chicago, Ill., have been incorporated with a capital of $15,000; hardware and steam fittings. The incorporators are: T. B. Bennett, J. J. Silts and H. E. Corbin.

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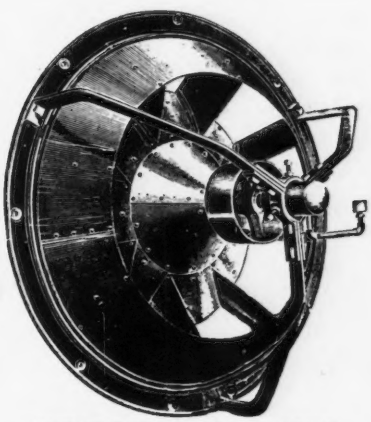
The Blackman and Duplex Cone Types



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WITH DIRECT CONNECTED ELECTRIC MOTORS OR STEAM ENGINES

FOR CATALOGUES, LIST OF USERS, SURVEYS AND ESTIMATES, ADDRESS

**HOWARD & MORSE, 45 Fulton St., New York**

MANUFACTURERS, ENGINEERS AND CONTRACTORS

**Bills Plumbing & Heating Co.,** Troy, N. Y., has been incorporated. The incorporators are: N. L. Bills, president; W. E. Bills, vice-president; Millard S. Groyer, secretary and treasurer.

**J. C. McQuarrie Co.,** New York, has been incorporated with a capital of $25,000; steam fitting, steam and hot water supply. The incorporators are: Joseph C. McQuarrie, Edward J. Fandrey and Anthony Doll.

**Success Plumbing & Heating Co.,** Kansas City, Kan., has been incorporated with a capital of $5,000. The incorporators are: Lawrence A. Fairley, John W. Friend and Oscar W. Ellis.

**Litchfield Heating Co.,** Litchfield, Ill., has been incorporated with a capital of $15,000. The officers are: Dr. G. A. Sihler, president; Edmund Sweeney, vice-president; Judge Paul McWilliams, secretary and treasurer.

**Reinke & May Heating Co.,** Milwaukee, Wis., has been incorporated with a capital stock of $2,000. The incorporators are: Wm. F. Reinke, Stanton C. May and Oscar H. Dittmar.

**Modern Plumbing & Heating Co.,** Des Moines, Ia., has been incorporated with a capital stock of $8,000. The officers are: Frank O. Anderson, president; Charles V. Veline, secretary and treasurer.

### Miscellaneous

**Chicago, Ill.**—An agreement between the Chicago employing and journeymen steamfitters has been signed and will be in effect till April, 1907. Under the agreement, the plumbers, steam and gas fitters receive alike, $4.50 a day. There are about 200 gas fitters in the union, 550 steam fitters and 1,200 plumbers.

### Contracts Awarded

**Raisler Heating Co.,** New York, steam heating the new Nurses' Home at Lebanon Hospital.

**Fuller & Warren Co.,** Boston, Mass., heating and ventilating the Washington street school at Wallingford, Conn.

**Machinery & Electrical Co.,** Los Angeles, Cal., installing a heating and ventilating plant in the Heyward Hotel.

**W. A. Heckman,** Reading, Pa., installing a steam heating plant in the West Pottsgrove township school building.

**Wirth & Winterbottom,** Falls City, Neb., installing a $4,000 steam heating plant in the government building at Laramie, Wyoming.

**Mulhearn Steam Heating Co.,** New York, steam heating the new 12-story apartment hotel at Eighty-sixth street and Central Park West, and also two 12-


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story apartment hotels on Amsterdam avenue, between West Seventy-second and West Seventy-third streets.

**Midgley Bros.**, Salt Lake City, Utah, plumbing and steam heating Fred Wey's new building on First South street. The contract amounts to $6,000.

**Jennison Plumbing Co.**, Fitchburg, Mass., piping, steam heating and sprinkler work in the factory of the Bay State Metal Wheel Company, at East Templeton, and installing a hot water heating plant and sprinkler system in a factory at Fitchburg.

**E. Best & Co.**, Quincy, Ill., steam heating the Mansion House at Pittsfield. The contract price is $1,250.

**W. T. Cantwell**, Utica, N. Y., installing plumbing, heating and fire sprinkler system in the new mill of the Avalon Knitting Company.

**F. A. Clegg & Co.**, Louisville, Ky., installing a heating and power plant in the Jones-Kennington Dry Goods Company's building at Jackson, Miss.

**F. Desormoux & Co.**, Springfield, Ohio, installing heating and lighting systems and plumbing in the boys' cottage at the Children's Home.

**James E. Granbery & Co.**, Baltimore, Md., plumbing, heating and ventilating the new Custom House at Gay and Lombard streets. $64,000.

**Hersh & Bro.**, Allentown, Pa., heating and sheet metal work in the new post office building at Allentown, and also in the post office at Lebanon.


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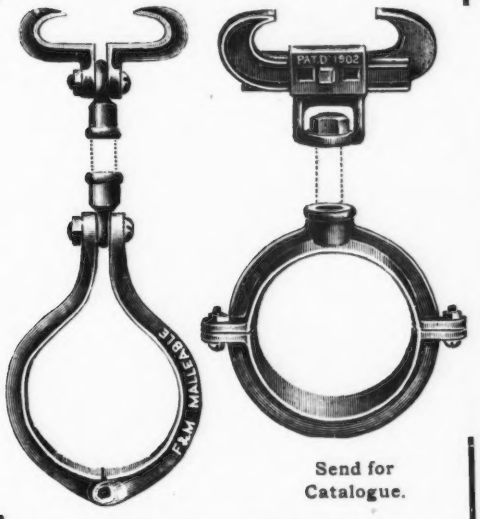


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**Iron City Heating Co.,** Pittsburg, Pa., heating the new Pennsylvania station at Freedom, Pa.

**Standard Temperature Regulation Co.,** New York, installing the temperature controlling systems in the new public schools, No. 2, Queens, and Nos. 38 and 151, Manhattan. The heating contract was awarded to Rossman & Bracken Co.

**Aura Behm & Co.,** Findlay, Ohio, installing a heating plant in the Farmers' Bank block, at Jenera, Ohio.

**Morris Graf & Co.,** Wilkinsburg, Pa., heating the Sewickley M. E. parsonage, at Sewickley, Pa.

**Geo. H. Fennel & Co.,** Cincinnati, Ohio, heating the Central Hotel at Newport, Ky.

**Henry Niemes,** Cincinnati, Ohio, installing a heating system in the Chas. Moser Co.'s building.

**Kidder Machine Co.,** Franklin Falls, N. H., heating the new public library.

**E. A. Cleland,** Lynchburg, Va., heating and plumbing the new public school at Rivermont.

**K. D. Horrall,** Olney, Ill., heating the Court House.

**James Donovan,** Middletown, Conn., installing the heating system in the Church of the Assumption, Ansonia, Conn.

**Lewis & Kitchen,** Kansas City, Mo., installing the plumbing and heating in school houses at Muskogee and Oklahoma City, Indian Territory.

**Judkins & Wallace,** Franklin Falls, N. H., installing the ventilation system in the new public library.

**Des Moines Mfg. Co.,** Des Moines, Ia., heating the City Hall.

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**Situation Wanted.**—Draughtsman, estimator, experienced in heating, ventilating and power work, desires situation with New York house. Address GORDON, care of HEATING AND VENTILATING MAGAZINE, 1123 Broadway, New York.

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